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SCIENTIFIC AMERICAN

JANUARY 11, 1913

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From a Painting by Gerrit A. Beneker

What Car Can I Afford to Buy?
The Automobile of the Future.
The Kerosene Automobile. How Tires are Made.

Vol. CVIII. No. 2 — Munn & Co., Inc., Publishers, New York, N.Y. — Price 15 Cents

See This New LOZIER *at the Shows*

THIS IS the first time the automobile industry has offered you a six-cylinder car of the very highest grade construction at a medium price. See the car—the Lozier "LIGHT SIX," a true Lozier for $3250—at the New York or Chicago shows. If you are not going to the shows, write us today for advance catalogue, photographic reproductions of exterior and interior of the car, and *all the information* about it. Then we can arrange, through the Lozier branch or agency nearest you, for you to see the car itself, to drive in it and know for yourself that it *is* a true Lozier in every part, every line, every little detail that makes for endurance, comfort and safety.

This new Lozier for $3250 is not so large as the Lozier you know now—that greatest of all high-grade $5000 cars—and not quite so powerful.

But the "LIGHT SIX" gives you Lozier *quality*, and by every true test you cannot get Lozier quality in any but a Lozier car.

On every touring highway in the world, and on every metropolitan boulevard, you find—in surpassing numbers—the men who *know* automobiles, the men who know them all, foreign and American-made alike, driving *Loziers*.

All over the country you find the people who are even *familiar* with automobiles speaking of Lozier with a regard which they attach to no other maker's name. Not because there are *great numbers* of Loziers all over the country, for there are not, but because of what the Lozier has *done*, because of what the name Lozier represents in six-cylinder construction.

One or two other makers have built Sixes as *long* as we have. But when that is said, all is said. For the public knows—*you* know—that the Lozier is the *only* Six that has figured prominently in the great national speed and endurance contests. You know that the Lozier holds, and *ever since* 1909 has held, the world's 24-hour stock chassis record. You can probably recall off-hand many of the great victories which have *proved* Lozier superiority of six-cylinder construction.

It is this proof of better construction, greater endurance, coupled with Lozier style and Lozier luxury and the fact that for 8 years the Lozier has commanded—and still commands—a price of $5000, that has made the name Lozier mean so much.

The new Lozier "LIGHT SIX" now brings Lozier quality within the reach of thousands of Lozier enthusiasts who have always wanted Loziers but who didn't feel they could afford to put $5000 into an automobile.

No wonder the announcement of the Lozier "LIGHT SIX" came as a sensation in automobile trade circles.

The trade knows what a Lozier for $3250 means. Scores of the best and strongest dealers closed contracts for Lozier agencies and made deposits for Lozier "LIGHT SIXES" without even seeing the car or knowing the details of its design and construction. They knew a Lozier is *always* a Lozier and that there is no other car to match it. And they knew a Lozier for $3250 was bound to be the sensation of the year.

Advance orders for the "LIGHT SIX" have justified our confidence and the trade's confidence in the demand for the new Lozier. Our branches and agencies will make deliveries promptly, but there is a limitation to the production, even with such magnificent facilities as ours, of cars built like every Lozier is built. Therefore, it will be to your advantage to see your Lozier dealer, or write to us, now.

LOZIER
"LIGHT SIX"
$3,250

Factors That Help Make This a Really Great Car

Left Side Drive, Center Control—Six-cylinder long stroke motor—Unit power plant—Special Lozier smokeless lubrication—127½ in. wheel base—36x4½ in. tires, demountable rims—"Stream line" body design, eliminating the old projecting dash—Gray and Davis Electric Starter and Electric Lighting System—Bosch Magneto, Dual Ignition—Wind Shield, built into body, adjustable for ventilation or rain vision—12 in. Turkish Upholstery—Warner Speedometer—Instantaneous Locking Tire Carrier—Tool Boxes concealed in Running Boards—Silk Mohair Top, Top Cover, curtains quickly adjustable from seat—Ball-bearing transmission—Floating Type Ball-Bearing Axle—Double enclosed Rear Brakes—Platform Spring Suspension—Multiple Disc Clutch—Large Gasoline Pressure-Feed Tank, with gauge—Full heavy nickeled trimmings—Clock and Electric Horn—Illuminated Running Boards—Robe Rail, Foot Rest and Folding Luggage-Rack—Corrugated Hard Rubber Steering Wheel, and many other features all on a par with these.

Five Body Types, Open and Enclosed

Ask for "LIGHT SIX" Advance Catalogue

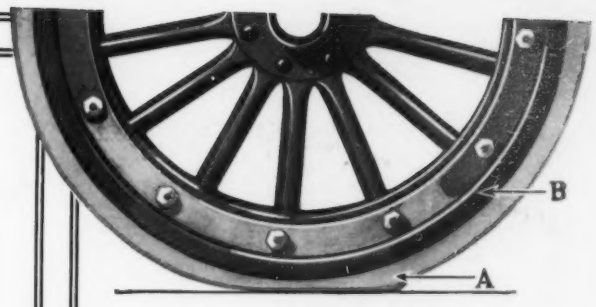
LOZIER MOTOR COMPANY, 4501 Mack Avenue, DETROIT, MICHIGAN

Works at Detroit, Michigan and Plattsburg, N. Y.

Factory Branches in New York, Chicago, Boston, Philadelphia and San Francisco. Dealers in all Principal Cities

STUDY the illustrations! They show how you can double the efficiency and profit of your heavy service truck.

The upper cut shows the "traction" wave always formed in the ordinary continuous tire under heavy load. This wave, caused by the bulging of the rubber, works into the base and tears the tire from its fastenings. It can't be avoided in any ordinary way. Then, too, this wave forms a constant hill—the tire is always climbing, retarding progress, reducing power efficiency.



Showing traction wave in ordinary continuous tire. (A) indicates where wave forms. (B) indicates base where roll and tread separation occur.

Contrast this condition with the profit-making worth of—

Firestone

Continuous Base—Notched Tread

Truck Tires

The lower cut shows how the Firestone Notched Tread overcomes the wave, by preventing its formation. This is *not* an individual block tire, with tread-tearing, metal-retaining plates. The Firestone continuous base is of the same tough, resilient compound as the tread. These tires hold the road, increase traction, absorb all vibration.

Get the full facts. They mean Economy and Increased Profits.

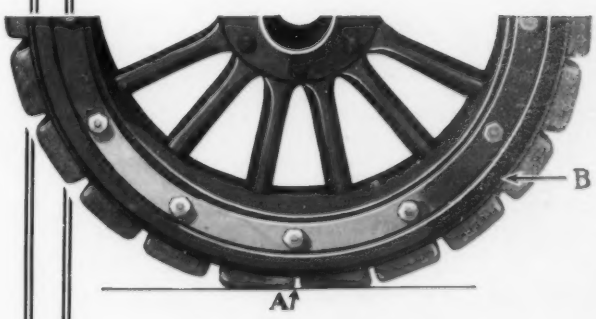
Firestone Truck Tires for Every Type of Car, Every Load, Every Road Condition

The Firestone Line of Truck Tires has in it the tire, solid or pneumatic, you need for your particular service. Get the books which tell the story. Ask, as well, for Quick Removable Rim facts. They are valuable.

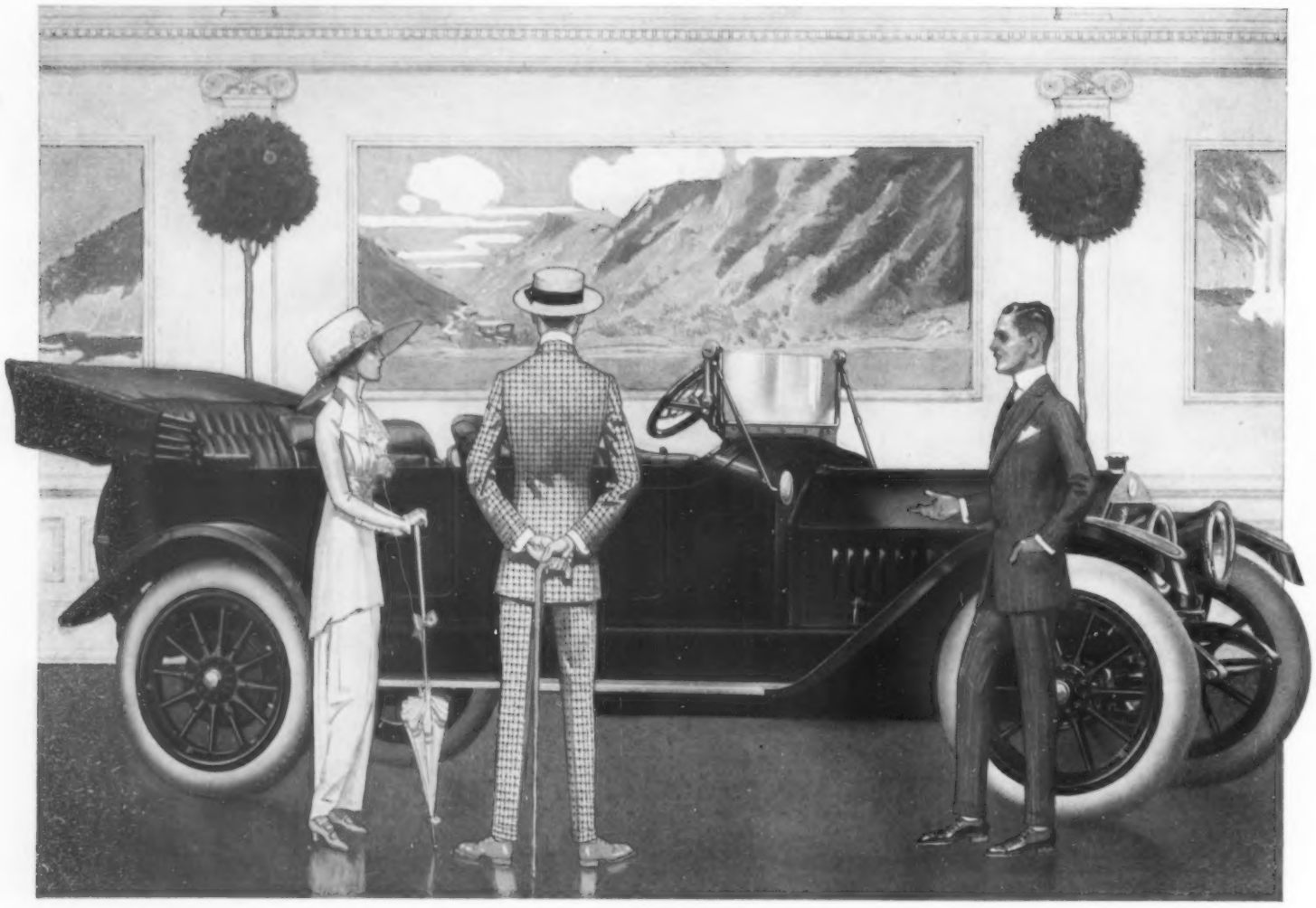
The Firestone Tire & Rubber Co.

"America's Largest Exclusive Tire and Rim Makers"

Akron, Ohio — Service Stations Everywhere



Showing how Firestone Notched Tires overcome destructive traction wave. (A) indicates wave passing off into space between blocks. (B) indicates continuous base—assuring absorption of vibration in every direction.



America's Greatest Touring Cars are Premier Sixes
The First of the Five Leading Makers to Establish the New Price Basis for the Six was the Premier

THE public has decided that the high-class car of the future must be a Six. The Premier is one of the four makers whose six-cylinder cars have created this six-cylinder demand. Seven years' production of successful sixes.

The Premier six-cylinder is not only a leader in price but in style and appointments. It is fitted with pneumatic starter, pneumatic tire inflator, independent electric lighting system, imported magneto, imported annular bearings, left hand drive, clean running boards, a cabinet mounted in the dash, providing a tool carrying compartment, gasoline fed by gravity with filling cap accessible without removing the cushions, luxurious upholstering, Turkish cushions, concealed hinges, and straight line bodies, finished with the pleasing touches which make for elegance and class.

Premier Sixes, $2735 to $4000

FULL TOURING CAR EQUIPMENT

The Premier has earned its position as one of the leaders among America's leading cars by its wonderful performance and successful showing in the most trying tours and contests each year

Manufactured by PREMIER MOTOR MFG. CO., Indianapolis

Premier Six as pilot in 1907 Glidden Tour

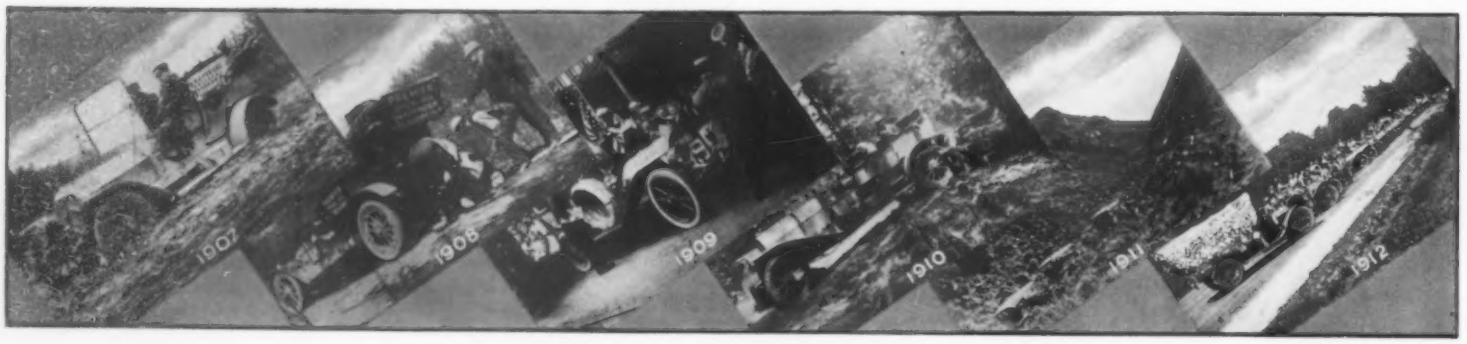
Premier Six laying out 1908 Glidden Tour in Ransleys Lake District

Premier Six, Chairman's pacemaking car starting from Detroit on Glidden Tour

Premier Six in the gumbo swamps of Tennessee in Glidden Tour

Premier Six, pilot of famous Ocean to Ocean Tour in 1911

The start of the Indiana Four States Tour, of the Premier Six and Premier Prairie Schooner, which crossed the Continent with the Ocean to Ocean tourists, in 1911



Cadillac STANDARD OF THE WORLD

Four years ago we recorded a prediction

The Prediction

Reproduced from Cadillac advertisements of December 1908

Ultimately the Cadillac will find its way into the hands of hundreds of owners who have heretofore paid twice and thrice as much money.

The deep-rooted conviction which these men naturally cherish—that there must be something lacking in the Cadillac to make such a price possible—is one which the Cadillac Company is eager to encounter wherever it can be found.

To meet and defeat that impression by practical demonstration during the ensuing season is of vastly more importance than the mere matter of sales.

The latter problem has been disposed of by a demand from dealers which has exhausted an output of ten thousand cars; and driven the factory to exert its fullest continuous capacity, night and day.

Of infinitely greater moment, as affecting the well-being of the Cadillac Company a year from to-day, and ten years thereafter, is the establishment of the principle that a high-powered car, of the highest grade, can be built to sell at a popular price.

Stripped to the chassis and subjected to the jealous scrutiny of experts in material and in mechanics: matched part against part, down to the last detail, with cars of known integrity sold at the highest market figure, the Cadillac will prove beyond question that such a car can be built at such a price.

But your investigation, proving that the Cadillac Company has made the impossible possible by heroic means and methods, will likewise demonstrate this, that

HIGH-POWERED CARS EQUAL TO THE WORLD'S BEST CAN BE BUILT TO SELL AT A POPULAR PRICE IN ONLY THE ONE FACTORY WHICH IS FITTED BY EXPERIENCE AND EQUIPMENT TO UNDERTAKE THE TREMENDOUS TASK.

Four years ago we foretold in our advertisements as reproduced in the appended column, that:—

Ultimately the Cadillac Motor Car would find its way into the hands of hundreds of owners who had theretofore paid twice and thrice as much money.

You must be conscious that the prophecy is being fulfilled; that the "hundreds" predicted is being realized in "thousands."

The prediction was not made in a spirit of vainglory.

Nor is its realization recorded now with any special sense of elation.

But the simple fact is interesting, and highly creditable.

Creditable, we mean, to the discernment of the American business man.

It is not easy to resist the glamor of the highest dollar mark.

It is not easy to believe that equal or greater excellence can be found at a lower price.

But that is precisely what has happened in the case of the Cadillac.

We felt four years ago that it must happen.

We were sure that no manufacturer could have higher ideals; or adhere more rigidly to those ideals.

The basis of a car's worth, of course, is the engineering practice and the factory practice which govern its construction.

That is the first excellence you strive to obtain when you pay the highest price.

And that was precisely the point in which the Cadillac was awarded world's precedence by the Royal Automobile Club of London.

We knew that in practice—*close measurement, standardization, alignment, proportion*—the Cadillac was not an aspirant but actually a leader.

We knew, in other words, that it was not surpassed; and that it was not even equalled in that respect.

And we knew, too, that that which went into the car could not be better.

We had no thought of emulating cars of higher price.

We were wholly engrossed in making the Cadillac the best of cars.

So, the fact that our prophecy has come true is an incidental, although an important result.

It has happened because we began with the positive conviction that—given a production of adequate size—no higher price than the price of the Cadillac was necessary for the highest type of motor car.

Surely your own Cadillac experience, the experience of every Cadillac owner in your community—and, indeed, of every Cadillac owner you have ever met anywhere in the world—justifies it.

The Cadillac is now the choice of thousands who were once wedded to cars of the highest price.

They have abandoned the recognition of the dollar-mark as the symbol of highest value.

It is one of the most interesting things that have occurred in motor car history—one of the most significant signs of enlightenment in buying that has occurred in latter-day America.

STYLES AND PRICES

Standard Touring Car, five passenger	$1975.00		
Six passenger car	$2075.00	Roadster, two passenger . . .	$1975.00
Phaeton, four passenger . .	1975.00	Coupe, four passenger	2500.00
Torpedo, four passenger . .	1975.00	Limousine, seven passenger . .	3250.00

All prices are F.O.B. Detroit, including top, windshield, demountable rims and full equipment

Cadillac STANDARD OF THE WORLD

CADILLAC MOTOR CAR CO., DETROIT, MICH.

Cadillac STANDARD OF THE WORLD

Electricity's Part in the Automobile

Electric Lighting

Edison Mazda Headlight (½ size)

Without the application of electricity it is probable that the automobile as we know it today would not be so convenient and safe a means of pleasure, business and travel.

The gasoline car is dependent on an electric spark, the electric car upon its storage batteries.

When lighting-up time comes, safety is in a large measure due to a dependable lighting system and satisfactory lamps.

On all representative cars ***Edison*** Mazda automobile lamps have been adopted as standard. Due to the large volume of light given by ***Edison*** Mazda Lamps for comparatively little current, electric generators and batteries were made small and light enough to be incorporated in the equipment of the modern, up-to-date car.

Protected sleeve connector for main line circuit between chassis and car body

The General Electric Company was not only the pioneer in the development of automobile lamps, but is today the largest manufacturer in the world of this type and of every other type of incandescent lamp.

This company is in the closest co-operation with car builders and makers of electric lighting systems—the result therefore is the most efficient lamp for all conditions of automobile service—the ***Edison*** Mazda. This lamp has a strong sturdy filament made from drawn tungsten wire. In connection with electric lighting, a number of wiring devices are made which facilitate connecting and disconnecting lamps for permanent or portable use. The switches which control the lights also bear that hallmark of quality of the largest electrical manufacturer in the world.

Three Circuit Snap Switch for controlling all lamps on car.

Electric Motors and Controllers

It is a real pleasure to step into a luxuriously fitted electric carriage and by the movement of a single lever apply and govern the propelling force. Nothing takes the mind from the fullest enjoyment of the ride.

Starting out in evening clothes, without a chauffeur, one can be sure of arriving at his destination with certainty and an unruffled temper if the car is equipped with a dependable power plant, furnished by the General Electric Company, such as has been adopted by electric car builders of the United States using more than 65% of all the electric vehicle motors built.

Automobile Motor "a size for every need"

This power plant is so unobtrusive and demands such infrequent inspection or adjustment, that its presence in the vehicle may almost be forgotten.

The motor of an electric car must be efficient and light in weight. This is to give the greatest possible touring radius on a single battery charge and thus preserve the life of the storage battery, which is dependent upon the number of times it is discharged.

Automobile motors made by the General Electric Company meet all these conditions and in addition absolutely prevent over discharge of the battery on steep grades.

The electrical design of the motor assures the best operating characteristics as well as embodies many important novel features which have made G-E motors pre-eminent in the world's haulage today.

The weight of the motors is reduced by the use of aluminium wherever possible and great strength is obtained by making the frame and head of a single piece cylindrical steel casting, machined from end to end.

Automobile Controller Continuous Torque Type

The controllers made by the General Electric Company are of the continuous torque type securing smooth acceleration and deceleration under all conditions. In both mechanical and electrical design they use the same features which have made G-E street car controllers the standard of the world today.

Because of the above reasons more than 65% of the electric motor and controller equipment used by automobile manufacturers of the United States is of G-E manufacture.

Many merchants who require absolutely dependable delivery service are using in the aggregate hundreds of electric trucks. Records show that these trucks are in use more days each year than any other kind of delivery vehicles and that their upkeep is much less.

These trucks climb the steepest hills in deep snow or plow through heavy mud with equal ease and certainty.

Electric Charging Devices

When Electric Automobiles were first introduced one of the most serious inconveniences connected with their use was to get the batteries charged.

This difficulty has been removed by the invention of the Mercury Arc Rectifier, an inexpensive, easily operated device for changing the alternating current of the ordinary lighting circuit to direct current suitable for charging storage batteries. With a Rectifier installed in the private garage the car does not have to be sent to the public garage for charging and is always ready for use. The General Electric Company makes a small rectifier known as the "Runabout" type, which has just the right capacity for charging the batteries of electric pleasure cars.

Operating a runabout type Mercury Arc Rectifier

When the current supply is from an electric railway circuit, a motor generator set is used in place of a rectifier, but where direct current lighting circuits are available, as in the downtown district of New York City, charging rheostats are all that is necessary.

In all cases the convenience and usefulness of an electric are greatly increased by reliable equipment for home charging.

The foregoing shows the many advantages due to electricity in its application to the automobile.

Wherever that silent power called electricity is used, there will be found skilled engineers, backed by the wide resources of the General Electric Company, perfecting the product—making the G-E monogram stand for the "guarantee of excellence of goods electrical."

General Electric Company

Largest Electrical Manufacturer in the World
General Office: Schenectady, N.Y.

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For Texas and Oklahoma business refer to Southwest General Electric Company (formerly Hobson Electric Co.)—Dallas, El Paso, Houston and Oklahoma City
For Canadian business refer to Canadian General Electric Company, Lt'd, Toronto, Ont.

3800

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVIII. NUMBER 2. ★ NEW YORK, JANUARY 11, 1913. ★ 15 CENTS A COPY $3.00 A YEAR

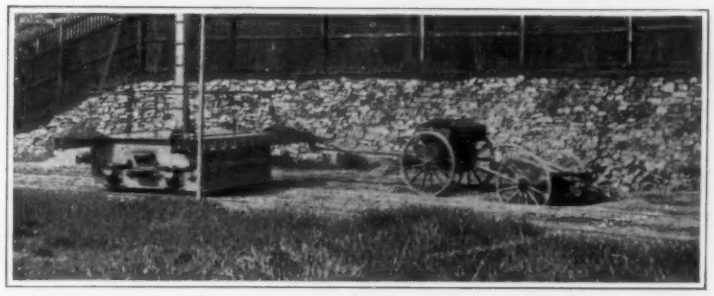
Grueling Tests for Artillery

By Our French Correspondent

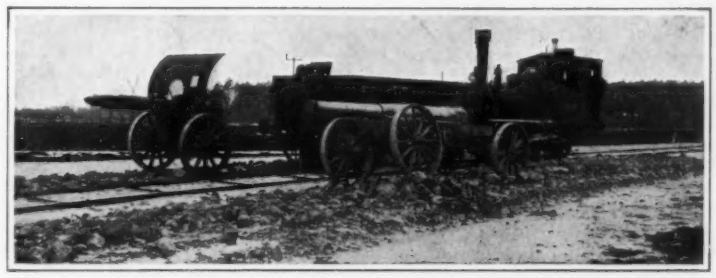
THE Krupp establishment is making use of some very efficient endurance or breakdown tests upon artillery, both for keeping up a check upon the standard types of pieces, and for testing new designs. One of the most novel methods is the use of a circular, electric, testing-track, upon which a car is run in order to draw the artillery pieces over the ground at slow or high speeds as may be required.

At the Essen artillery grounds, which lie near the main factories, there is laid out a circular railroad track with a special kind of electric car running upon it, for making the tests upon the artillery. The track has 210 feet mean diameter, which gives it a total length of about 650 feet, being substantially laid on beton and using a single rail on the outer side and a double rail on the inner circle so as to keep the car from running off the track. The railroad track proper is usually reserved for the electric car, while the artillery is run on a circular way, which lies on the inside and also on the outside of the main track, thus allowing two pieces to be drawn along at the same time. The artillery track is slightly banked. The railroad track has a 7-foot 6-inch gage, and, if desired, the artillery can also be run in the space between the rails. In order to vary the tests, the nature of the ground is made different upon various parts of the circular tracks. For instance some 320 feet of the track or about half the circle is laid with a good stone paving, while the remainder represents country roads in more or less good condition. Upon these different stretches of road there can be placed obstacles of various kinds such as timber lying across the road, ditches or holes and the like. The use of the electric car for drawing the artillery has an advantage from the great number of different running speeds which can be employed, representing what a team of horses would give at a trot or gallop; and much higher speeds can be used when desired.

On the upper floor of a cabin is an inspection room, which serves for engineers or official committees when making certain tests upon the artillery, whence the track can be overlooked. Signals can be sent from the track into the cabin in order to give notice to the operators, and for this use there are placed six signal posts around the track so as to send electric bell signals to the cabin during the maneuvers for changing speed or stopping and the like. Across the car is a bar to which the tongue of the artillery piece can be attached so as to run it on the outer, middle or inner track. The car is started up and the piece is taken around at the different speeds which may be required for any given case, so that it will be seen that the electric track allows any such maneuvers to be made very quickly and avoids loss of time. As regards the obstacles which are put in the way of the artillery piece to give it a severe endurance test, one of our engravings shows a field howitzer taken over a heavy piece of round timber and at a high rate of speed. Seeing that the artillery piece springs up to a considerable height and then falls on the ground, and that its total weight is 2.4 tons, an idea of the good quality of the axles and wheels will be obtained. Another illustration represents an ammunition wagon being drawn at a high rate by the car and passing over a steep ditch dug on the track at this point. It should be stated that the track is well lighted by arc and incandescent lamps. Up to the present time the tests which cover a period of several years amount to as much as 40,000 miles run upon the circular track.

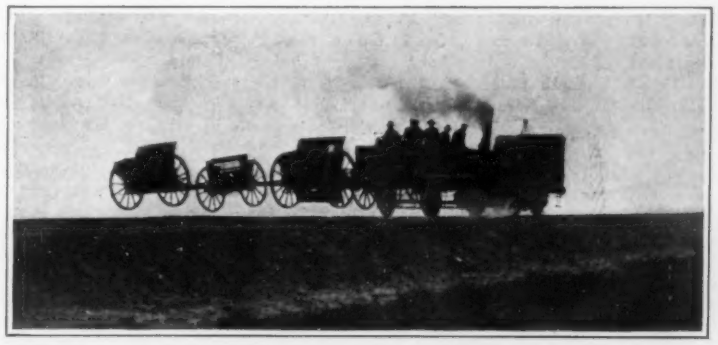


Electric motor dragging an ammunition caisson through a hole with steep sides.

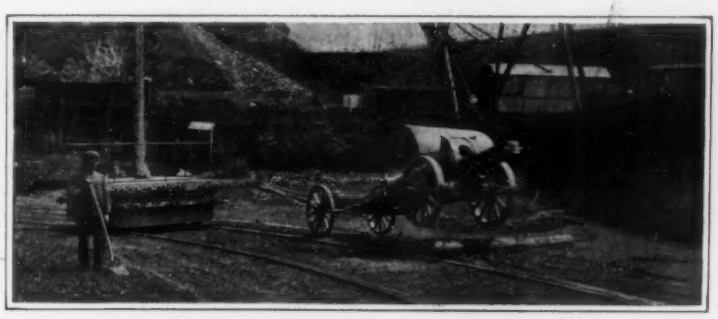


A test over prepared roadway composed of large stones and boulders.

Recoil siege cannon upon carriage drawn by horses, clearing a wooden obstacle at the testing ground of Tangerhütte.



Two field guns and their fore-carriages drawn by a steam locomotive over obstacles consisting of railway rails.



Testing track at Essen. Field mortar clearing a round log placed across the track.

Some very severe tests of another kind are obtained by the use of steam locomotives running on a special stretch of railroad track at the company's artillery grounds at Meppen. At each side of the track is laid out a proving way containing surfaces of varied character or special obstacles. Our engraving shows two artillery pieces attached to a cross-bar, each running on a separate way. Here the road is made up of heavy broken stone. When the locomotive is run at high speed this gives a very severe test, and in some cases the artillery pieces jump bodily from the road to a considerable height. This is the case in our present figure, where the obstacles consist of railroad rails laid crosswise and spaced along the way.

Other endurance tests of artillery are made upon actual roads in the country, using a team of horses as one of our photographs shows. The field piece is here passing over a very high obstacle formed of three logs bound together, and it springs a conspicuous height off the road.

Showing Visitors How Cars Are Made

SOME of the labor-saving devices which were described in a recent issue of the SCIENTIFIC AMERICAN, will be shown to the visitors of the New York automobile show in Madison Square Garden. Several typical "multiple production" machines will be exhibited in operation, turning out standard parts in the same manner as it is done in the large automobile factories. This part of the exhibition will probably draw larger crowds than the mere show of the cars, for every one likes to know "how the thing is done."

Automobile Accidents in Paris

ACCIDENTS due to automobiles are becoming more frequent in Paris, owing to the development of the "taxiauto" cab and autobus. The official figures for last July show a total of 170 accidents during the month, of which the taxicabs are responsible for 59 accidents, with 2 deaths. For the autobus there are 13 accidents with but 1 death. The tramways figure for 20 (6 deaths), and private automobiles make up the remainder. It will thus appear that the autobus is not responsible for as many accidents as might be thought, and the complaints made by the public appear to be unfounded.

The Automobile in Egypt

THE use of automobiles is becoming quite extensive in Egypt within a recent date, especially at Alexandria and Cairo. The latest figures show as many as 563 cars registered at Cairo alone. Even though all of these are not in circulation, it is estimated that at least 400 are in regular use, and these are running almost entirely within the city. Outside of town there are but few roads, such as the Pyramids, Heliopolis and Rod-el-Farag routes. At Alexandria there are counted 167 automobiles. The only good road outside the city is the 8-mile route leading to the resort of San Stefano.

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JANUARY 11, 1913

Published by Munn & Co., Incorporated, Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

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The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Century's Decline in American Shipping

THE thirteen original States either bordered on or had easy access to the sea, and the First Congress, recognizing the importance and promise of our maritime interests, allowed a rebate of ten per cent of the duty on all goods brought into this country in American vessels. That was in 1789. Under the stimulus of this wise provision, our ships multiplied, and their enterprising skippers sailed them to the remotest ports of the seven seas. In spite of the British Embargo Act of 1808, matters went so well with our Merchant Marine that in the year 1826 only eight per cent of our foreign commerce was carried in foreign ships. To-day, nearly a century later, the situation has been so completely reversed, that only eight per cent of our large and rapidly growing foreign commerce enters the ports of this country under the American flag.

The decadence of our over-sea shipping is due to more than one cause; but there can be no doubt that the first and most vital blow against this industry occurred shortly after the war of 1812, when several reciprocal treaties were made with the leading maritime nations, under which it was agreed to levy the same duty upon American as on foreign ships. In spite of this withdrawal of Government aid, the owners and masters and the excellent crews of that day carried on the competition so successfully that, during a period in the middle of the nineteenth century preceding our Civil War, the Merchant Marine of the United States took precedence of every other, not merely in tonnage, but in the speed and weatherly qualities of its ships and the fine seamanship of the men who sailed them.

It was when our Merchant Marine was at the zenith of its prosperity that two developments of great significance, one political, the other industrial, were in progress which were ultimately to sweep our flag from the high seas. The Civil War completely disorganized our deep-sea carrying trade. The sale and transfer of American ships, the depredations of the Confederate cruisers, and the withdrawal of our merchant ships for cruiser and transport service in the South, combined to strike a terrible blow against our maritime interests. From this, however, we might have recovered, had it not been for a momentous industrial change, which proved even yet more fatal. This was the coming of the age of iron and steel and the substitution of these materials for wood in the construction of ships; for we were without either the materials or the facilities for steel ship construction. Great Britain, on the other hand, had both. At once, under the altered conditions, that country began to move forward to the absolute supremacy which she has since established; on the other hand, our marine industry, already staggering under the blow dealt by the Civil War, continued steadily to decline. After the war, the opening up of the West by the construction of railroads and the development of the vast internal resources of the country, offered so promising a field for capital, that a national indifference and neglect was added to the other destructive causes above enumerated. Also the great demand for highly-paid labor in the interior of the country robbed the sea of its one-time attraction, and in ever-increasing numbers our young men turned from the forecastle to the machine shop and the factory.

Something has been done toward the resuscitation of our shipping by the admission of materials for shipbuilding free of duty; but further measures are necessary. There still remains the great difference in wages and general cost of operation, and something should be done by the Government to off-set this. At the present writing it looks as though the needed relief could be found by a return to the successful plan adopted by the First Congress, and allowing a moderate rebate on all goods imported in American bottoms.

The Car of 1913

ALTHOUGH there is a greater difference in automobiles generally this year than there ever was before, it is not of the kind that the average person has as yet come to know or to realize. In other words, it is not so much a difference in lines or appearance—this year's cars will appear much the same as their predecessors—as it is a deeper-rooted difference that reveals itself in greater efficiency, greater stamina and greater wearing qualities. The difference between goodness and mediocrity lies now, more than ever, in detail rather than in general.

The use of a better grade of materials, primarily, is responsible for the improvement. The design and construction of present-day cars would seem to indicate that the factor-of-safety bugaboo, which has necessitated comparatively massive construction, to the detriment of car efficiency, has been silenced for all time. True economy, apparent in the use of comparatively expensive vanadium and other alloy steels, rapidly is coming to the fore, and that it has had a beneficial effect in simultaneously reducing weight and increasing strength scarcely can be denied.

Latterly, vanadium has been alloyed with iron for cylinder construction, thereby directly increasing engine efficiency by reducing the ratio of weight to power. It is much the same with copper and aluminum alloys; great strides have been made in metallurgy during the comparatively short space of time embraced in the past twelvemonth; and though it may cause some a pang of regret that progress of the kind is more or less obscure and is not directly convertible into capital through the medium of exhibition, it nevertheless represents the sound foundation upon which reputations are built, and, incidentally, it illuminates the dividing line between the good cars of yesterday and the better cars of to-day.

Design, too, has made strides that are not to be disputed. There is a marked tendency toward the greater rigidity and simplicity attained by the method of casting cylinders in a single block; the integral casting of intake and exhaust gas passages is only one of the plainly visible evidences of successful attempts at better construction. More attention has been paid to the generally recognized necessity for segregating the magneto and the carburetor in order to reduce the hazard of fire, and, as a rule, ignition apparatus has been more carefully located where it is less exposed to the insidious action of dirt and water.

In the construction of engine components, the careful attention which has been given the lightening and balancing of reciprocating parts has played an important part. Pistons and connecting rods now are considerably lighter than they were. In the majority of factories, crankshafts and even flywheels are carefully balanced, both statically and in the running balance machine which has come into extensive use only within the past year, and which has been of recognized value in detecting and directing the correction of faults that result in vibration. Notable advances have been made, also, in the design of valve mechanism, which now is quieter than ever before. Cam shapes remain practically unchanged, though the increasing use of spirally cut gears and silent chains in camshaft driving mechanism has permitted a nearer approach to silence and rendered valve action more positive.

The passing of many city ordinances prohibiting smoke has necessitated the perfection of lubricating systems, and with the perfection automatically has come greater efficiency; oil bills have been cut virtually in halves. The trough system, originally developed for use in Knight type engines, is coming into vogue for poppet valve engines, and auxiliary throttle-controlled systems have been adopted by several prominent manufacturers.

What has been said with regard to the lightening and balancing of engine parts applies with equal force to the clutch. The use of pressed steel parts for cone clutches, which type still appears to be the favorite, has materially lightened the *ensemble* without reducing strength. The lightening, of course, has reduced the tendency to "spin" and in this way has operated to reduce the wear and tear on transmission elements. Spring inserts, which insure against gripping and slipping, are used quite as much as cork inserts, and both are far more popular than they were last year.

Change gear sets have suffered but little alteration in their material aspects. Four forward speeds, however, instead of three, are used to a greater extent than they were, and their advantages no longer are confined to high-priced, or even moderate-priced, cars; several manufacturers whose products list at less than $1,300 have announced four-speed gear sets for the first time this year, thus probably marking the forerunner of their more general adoption for low-priced cars. The importance of the metallurgist in the treatment of gear steels is another factor which likely will be realized some years hence, when the gears in 1913 cars are still doing duty and the gears of yesteryear have passed away.

There are just two other things wherein even a casual glance will serve to convey the marked superiority of the 1913 car. The first of these is the noteworthy reduction of rattles and squeaks, which have emanated from brake parts, fenders and springs, and the other is the completeness with which the newer crop of cars is equipped. The former can be attributed only to better construction, and the latter is but the natural outcome of steadily growing demand.

A National Aerodynamic Laboratory

THAT aviation has made the advances it has in this country is very rightly a source of wonderment, because the inventor, the designer, and the builder have all had to grope their way, trusting to incomplete experiments and to empirical formulæ that left much to be desired. Aviation has undoubtedly come to stay, but we have still much to learn before it can be classed with yachting so far as risks are concerned; but fortunately this information can be obtained in a national aerodynamic laboratory without hazard.

The part the model experimental basin has played in the successful evolution of modern ships is a matter of general knowledge. Enormous economies have been effected and the science of naval architecture is advanced. These results have been the substantial return for fairly modest investments. In brief, they have supplanted the rule of thumb and the guesswork of other days. Kindred work is that of the aerodynamic laboratory. A number of European nations have established plants of this sort to their undoubted advantage.

The need of similar facilities in this country has been forcefully urged by Capt. Washington I. Chambers, U. S. N., who is in charge of aviation in our navy. To quote Capt. Chambers:

> "Little more than a year ago, our knowledge of the effect of air currents upon aeroplane surfaces was almost entirely a matter of theory. The exact information available was so meager that aeroplanes were built either as copies, slightly modified, of other machines, *or else by way of haphazard experiment*. This state of affairs obtains to some extent in the United States to-day, although in Europe aeroplane construction is now largely based on scientific data obtained at notable aerodynamic laboratories. The intuitive, hasty, and crude methods of the pioneer cannot succeed in competition with the accurate and systematic methods of the scientific engineer, and it is beginning to dawn upon our perceptions that through lack of preparation for the work of the scientific engineer, i. e., through delay in establishing an aerodynamic laboratory, a waste of time and money, a decline of prestige, and an unnecessary sacrifice of human life have already resulted."

A national aerodynamic laboratory, such as our naval aviation expert recommends, might well be located in Washington where many established facilities could lend their aid, and the rest of the needful plant could be provided at a cost of probably not more than $200,000. Such an institution, presided over by broad-minded men, would be a benefaction to everyone either directly or indirectly interested or concerned in the promotion of aerial navigation.

The work of such a laboratory would logically divide itself into two main divisions: experimental verification, and experimental research. The first would deal essentially with problems as they stand and lead to the formulating of certain standards; but unquestionably the most valuable results would be the fruit of research work prosecuted continuously, systematically, and patiently in the thorough and precise investigation of new ideas or of old ideas with new applications, and in this way discovering general laws and formulæ. In the language of Capt. Chambers this order of procedure "is the short cut to substantial efficiency, economy, improvement, and prestige."

It is not necessary here to mention the apparatus or particular equipment which an aerodynamic laboratory should have. The plant of M. Gustave Eiffel at Auteuil, the trial track at St. Cyr, France, the laboratory of the Italians, the facilities of the Russians at Koutchino, and the splendid German and English institutions show us what we must have. Our own inventive resourcefulness will probably suggest developments. Aviation will mean in the air just what the evolution of the automobile has meant in daily life on the ground, and its adaptations will be quite as varied. Of course, the fighting man is primarily interested in that field, and so is our citizenry, too, because it has already been shown that of two battling countries, the one that has a superior aerial fighting force will surely hold a very great advantage. This is not the prophetic conclusion of the enthusiast, but the actual fact as proved by the results of the Balkan uprising.

Congress saw fit to establish our model experimental basin at the Navy Yard in Washington. Let us trust that the same legislative wisdom will provide a national aerodynamic laboratory. The cost will be modest, but the results will be invaluable.

Electricity

Electrically Operated Suspended Railway.—A novel way of mountain climbing is provided in the new electric suspended railway up the Kohlererberg, in the Tyrolese Mountains. The suspension cables, 5,400 feet in length, are carried on twelve steel supports, and two cars each accommodating fifteen passengers and the driver are operated, one being hauled up the hill by duplicate traction cables while the other is descending. Complete safety appliances are provided, and a magnificent view is opened out as the car rides steadily and smoothly up the 2,760 feet from the Eisack in thirteen minutes.

Picture Telegraphy Across the Atlantic.—Although the Berlin scientist, Dr. Korn, is having good success in sending photographs by wire between stations located at Paris, Berlin and Monte Carlo for use in press work, he wishes to apply his method over a much longer distance. In fact, it is possible to send the photographs by mail between Paris and Berlin, for instance, in a comparatively short time, so that the newspapers are not as likely to take up a picture-transmitting scheme as when they are a long distance from the center of events. For this reason he expects to take up the question of operating upon the Atlantic cable and is confident that he will be able to send photographs across the ocean. He is also considering the matter of coming to America in order to apply the system to a line between New York and San Francisco. We illustrated this apparatus not long ago.

Electric Stage Service Across the Alps.—Quite an extensive project is being organized in Switzerland for an electric automobile service across the Alps, and the cost of improving the roads and purchase of material is about half a million. The line runs from Airolo by way of the Bedretto valley and the Nufnen pass, ending at Ulrichen in the Valais region, with a total length of 25 miles. Considerable work will need to be done in enlarging the routes so as to make them suitable for automobile traffic, and a bridge is to be built over the Tessin River. The new electric automobiles have capacity for 22 passengers and make the trip in 2¼ hours on ordinary and 1¾ on express service, running at 12 to 22 miles an hour. There are eight to ten stations along the route and three trips are made per day in each direction, during all seasons when there is no snow on the roads. A great success is predicted for the electric line.

How a Paris Central Station Gained by the Change to Greenwich Time.—The fact that Paris adopted Greenwich time not long ago causes an electric-light station to gain $20,000 a year, according to an estimate. The reason for this somewhat curious result lies in the difference of time of burning electric lamps, and even though this is very small, it figures up in a yearly estimate to quite an extent. Greenwich time of 5 o'clock corresponds to 5.10 Paris time, for instance. Lamps are turned on according to the amount of daylight, but offices close at a fixed hour. Should an office close at 6 o'clock, it is evident that the lamps will have burned 10 minutes longer, owing to the change over to Greenwich time. The extra amount of current is naturally paid for by the users, so that this makes the central station gain about 1 per cent, and even this small difference applied to the case of an electric plant furnishing 15,000,000 kilowatts a year, will give the above increase.

Cableway to the Col du Midi.—A suspended cableway is now building on Mont Blanc and it will reach the elevated point of the Col du Midi, which is not far from the summit. It follows somewhat the general lines of the Wetterhorn cableway, and like the former it is designed on the Ceretti-Tanfani system. The terminus of the cableway is on the Col du Midi, 11,700 feet high, this being somewhat below the well-known peak of Aiguille du Midi, (12,600 feet), but the latter was rejected in favor of the former owing to lack of space at the peak to make a suitable landing place. The car hangs down from a roller carriage traveling on a single main cable which is stretched along the route upon structural iron towers. There is an upgoing and a downgoing car as in a cable incline, the car being drawn along by a cable working upon sheaves at each end. What is novel is the use of an extra cable running along under the main cable and passing through the carriage. Usually it runs idle, but should the main cable break, it then serves to support the carriage by a set of rollers so as to take the place of the former and the car can still run. Should the towing cable break, on the other hand, the extra cable now serves to draw the car into the station, thus playing a double part in accidents. The line is about 3 miles long in horizontal projection and starts from the Pelerins station at an altitude of 3,400 feet, and ending at the Col du Midi 8,300 feet higher. The lower end lies near Chamonix, and the railroad runs quite near this point. It is laid out in four sections to avoid using too long spans, so that passengers change cars three times. The maximum length of span allowed is 3,300 feet on account of the strain on the towers. The second station is at La Para and the third at Bossons glacier. It is proposed to run an automobile service to bring tourists from Chamonix to the lower station. One section of the cableway is nearly finished and the whole will be running in 1916.

Science

The International Union for Solar Research, which last met on Mt. Wilson, Cal., in 1910, will hold its next meeting at Bonn, beginning August 1st, 1913.

An Oyster-shell Building.—A five-story concrete building, the concrete being made of oyster shell from the reefs of Galveston Bay, has been erected at Galveston, Texas. The owners of the building and its constructors, Nic. Bohn and G. Tietze, claim this material is better and cheaper than concrete made with gravel. Shell concrete built into a wall 3 feet high and 336 feet long in 1882 withstood the severe test of fire and water and is to-day as sound as when built. It is estimated that the shells of 5,896,000 oysters are imbedded in the walls of this building. This is said to be the only building of its kind in the world.

The British Association for the Advancement of Science will meet in Australia, for the first time, August, 1914. The Association has met three times in Canada, and once in South Africa, but all the other meetings have been held in the British Isles. The Australian meeting will include sessions at several towns. The commonwealth government has appointed a federal council to arrange for the meeting, under the patronage of the governor-general, and with the prime minister as chairman, and has granted £15,000 to pay the passage to Australia of not fewer than 150 official representatives. A number of foreign men of science will be included in this number.

Effects of Indol in Producing Symptoms of Senility.—Some interesting experiments as to the effect of the chemical compound indol in producing sclerosis have just been conducted by a pupil of Metchnikoff. Indol is one of the toxins secreted by intestinal bacteria, and Metchnikoff has claimed that it was responsible for certain symptoms of senility. In the experiments referred to doses of 0.04 grain of indol were injected into guinea-pigs. Not only was sclerosis of the aorta observed, but the liver, kidneys, and suprarenals were affected and there was a tendency to hardening of the brain. Since these are all symptoms of age, Metchinkoff's theory seems thus far supported.

The Electrical Resistance of Trees has been made the subject of some elaborate experiments by G. E. Stone and G. H. Chapman at the Massachusetts Agricultural Experiment Station. It was previously known that trees possess relatively high resistance—an important quality, as serving to protect them from lightning—and that the resistance varies for different kinds of tissues. Messrs. Stone and Chapman's investigations reveal the further fact that the resistance varies markedly with the temperature, being higher with a low temperature and lower with a high temperature. This fact results in a diurnal and an annual period in the resistance. The cambium layer shows the least electrical resistance. This is followed by the phloem and the sapwood.

Aeronautical Weather Station in England.—The British Meteorological Office has arranged to operate a branch of its service at the Royal Aircraft Factory, South Farnborough, for the purpose of supplying meteorological information and forecasts in a form directly applicable for the guidance of airmen, and also for carrying on investigations of meteorological problems for the Advisory Committee on Aeronautics. Mr. J. S. Dines has been appointed meteorologist in charge. The equipment will include pilot and sounding balloons and laboratory appliances, in addition to the ordinary meteorological apparatus. Special forecasts and warnings for aeronauts will be issued on the basis of information telephoned from the Meteorological Office at South Kensington.

The Economics of Mountain Snowfall.—The attention of American meteorologists has been directed in recent years to the great importance of the winter snowfall in the mountains of semi-arid western states as a source of the water available for agricultural purposes or for motive power the following summer. A dual problem has been under investigation: (1) the development of methods of measuring the volume of snow lying on the mountain slopes, as a means of predicting the amount of water it will yield; and (2) the conservation of the snow by appropriate treatment of the forest cover. Among the interesting discoveries made in this connection is the fact that the ideal forest for snow conservation is one filled with glades whose area bears such proportion to the height of the trees that, while snow enters freely, the wind and sun cannot reach the bottom. The production of such glade by cutting and pruning, as well as by planting trees of suitable species (e. g., the mountain hemlock), becomes, therefore, a part of forest practice in the regions in question. Aside from investigations by the Weather Bureau and other government institutions, this subject has been most actively studied by the excellent meteorological department of the University of Nevada, which is now planning to offer a special course for foresters on the relation of mountains and forests to the conservation of snow. An adjunct of this university is the well-known meteorological observatory on Mount Rose.

Automobile

International Automobile Shows.—International exhibitions of automobiles have been planned for January 11th to 22nd, in Brussels, Belgium; and for the months of March, April and May in Vienna, Turin, Budapesth, St. Petersburg, Berlin and Stockholm.

The Footstool-lunch Basket.—By way of killing two birds with one stone, so to speak, an enterprising accessory manufacturer has developed an automobile lunch basket which serves a dual purpose in that it is a footstool as well. The basket proper is made of wicker-ware and is fitted with the usual knives and forks, cups and saucers, etc., with a liberal space for the storage of food. The top is slanting and strong and is covered with leather to resist wear. It is designed to be placed in the tonneau.

The Deep Cushion.—Just where the deepening of cushions will end, unless it ends on the floor of the car, no man can tell at present. When ten-inch cushions were advertised as the acme of perfection, enterprising manufacturers almost immediately announced twelve-inch upholstery and two more lately have gone to the length of providing cushions no less than fourteen inches in thickness. The saving grace of an otherwise ludicrous situation is that the deepening of cushions in general has had a distinctly beneficial effect—for the car owner, of course.

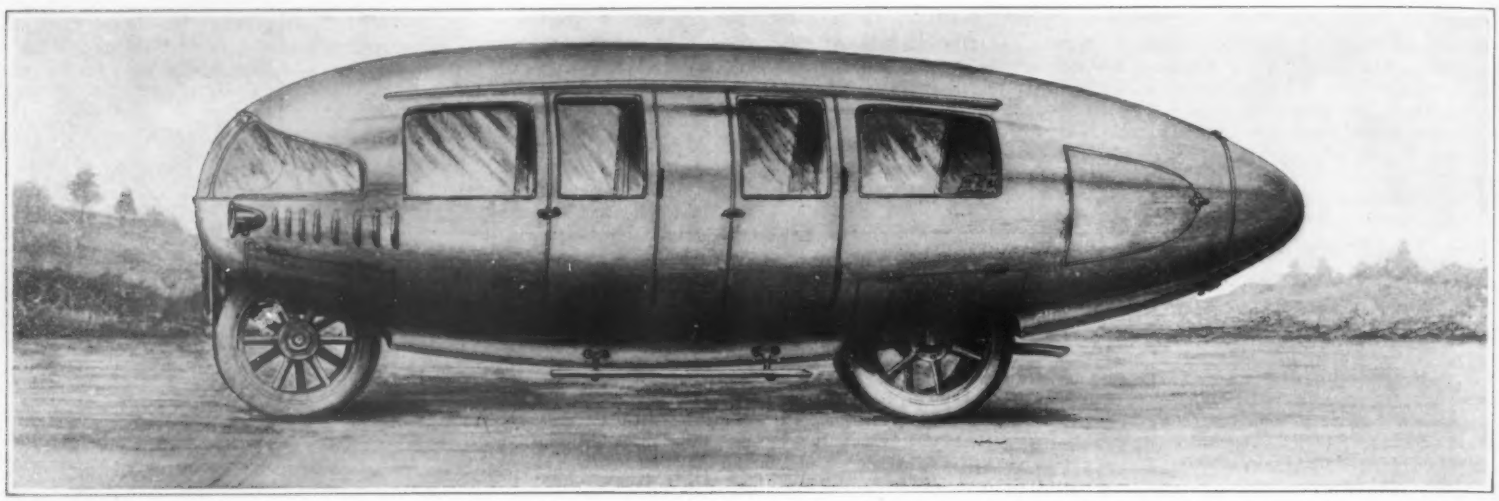
Guessing at Speeds.—Demonstrating the deceptive nature of speed judging by sight alone, the results of a test recently held by a British automobile club are interesting. Several motorists were lined up on an unfrequented road and required to estimate the speed of a car driven at a predetermined rate with the aid of a speedometer. Out of four trial runs at various speeds only two speeds were guessed by one person correctly. The others varied from the correct speeds to such an extent as to emphasize very forcibly that it is practically impossible, without extensive practice, to judge of the speed of a car merely by watching it pass.

"Clean Design" in Cars.—"There are no kinks, no corners nor gable-end projections at dash or elsewhere," advertises a well-known foreign manufacturer in bringing to public notice his latest creation. Which, briefly, is exactly what the present American car accents. Never before has the striving for "clean design" been so apparent in American products. Unsightly tool boxes which heretofore have cluttered up running boards have been relegated to places of less conspicuousness and the "blending" of lines at dash and at tonneau is a marked contrast to the angles and generally unfinished appearance ushered in with the adoption of front doors.

The Long-stroke Motor.—Imported from abroad, where it flourished long before it got to America, no waning is apparent in the popularity of the long-stroke motor. From a conservative middle ground, manufacturers apparently are getting to the extreme in stroke to bore ratios and the wisdom of the practice well may be doubted. Among the later developments, announced for the coming season, are two motors from the same manufacturer, one of which measures $3\frac{3}{8} \times 6$ and the other measures $4\frac{1}{4} \times 7$. It is true that motors with even longer strokes than these have given a measure of success abroad and they therefore cannot be viewed wholly in the light of experiments. Time only, on the road, in the hands of owners, can tell just how much the designer has bettered existing conditions by his plans.

The Filled Tire.—Periodically, almost continuously, the cellular, spongy or gelatinous tire-filling compound which is expected to replace the air in pneumatic tires makes its appearance, floats for a moment in the public eye and then fades away into the future. But it must not necessarily be assumed that such will always be the case and that success in this direction never will be obtained. The repeated resurrection of the idea shows the existence of a latent demand and it is quite within the bounds of possibility that the demand may some day be filled. Already there are several such compounds on the market which are giving a measure of success and in them their manufacturer, or compounders, would seem to have eliminated many of the difficulties which at first were experienced with everything that was supposed to take the place of air and banish tire troubles forever.

Wire Wheels.—Despite the fact that the automobile undoubtedly has reached a noteworthy plane of efficiency and dependability there can be little reason to suspect that finality of design has been reached. There are few manufacturers who have not something new to offer either in the way of equipment or design that has been slightly altered still further to increase efficiency and to reduce the small amount of physical labor necessary in the operation of any car. More than ordinarily prominent among the changes which will be evident in the car of 1913, and which can be listed under the heading "tendency in design," is the widespread movement in favor of wire wheels. Already more than a score of manufacturers have specified wire wheels as optional equipment and three or four have taken the bull by the horns, in a manner of speaking, and have specified wire wheels as standard equipment, with wooden artillery wheels optional.



In outward appearance the "car of the future" resembles a submarine boat more than it does a carriage. Its long cigar-shaped body incloses everything except the wheels, and even they are covered for almost half of their diameter.

The Future Car

How Car Bodies Have Developed at Home and Abroad

By Walter Baunard

In automobile designing as well as in political movements coming events cast their shadows before them. If we would visualize the car of the future, we have only to study the car of the past. That is the object of this article. In order to obtain a correct impression of the automobile of the future, the author has presented and criticised both the European and American cars designed during the last twelve years.—EDITOR.

THAT the first automobile bodies were in all respects nothing but adaptations of the older carriage bodies, is fairly well known. Many of the readers of this periodical will remember the first cars of a dozen years ago, and their awkward appearance. They were the product of a compromise—and, like most compromises, were very unsatisfactory. That the motor-driven carriage was a thing apart and different from the horse-drawn rig early became evident to thoughtful designers of automobile bodies. But while they well realized the necessity of striking out in different directions, they were not at all anxious to make radical innovations. The conservatism of the majority of the human race resents upheavals of any kind, preferring rather a gradual elimination of the undesirable. The change from carriage body to automobile body therefore had to be made slowly, and at the present time we have about arrived at the half-way station. The automobile of the future will look no more like the motor car of to-day than the limousine of 1913 looks like the *dos-à-dos* of 1896. The limousine or torpedo touring car of the present year is but a link in the gradual transformation of the horse-drawn buggy into the completely enclosed, dust-proof, silent and comfortable "car of the future."

In outward appearance the "car of the future" resembles a submarine boat more than it does a carriage. Its long cigar-shaped body incloses everything except the wheels, and even they are covered for almost half of their diameter. To the eye of the motorist of 1913 it may present too "squat" an appearance, owing chiefly to the low position of the body. The car has no running boards, no hood, no mudguards, no windshield and no flapping top. The motor is carried in front of the driver, as in the ordinary motor car, while the various indicators are placed within easier reach of the driver's hand than is possible in the orthodox vertical or sloping dashboard arrangement. The curved plate-glass front of the body affords a clear view of the road ahead, while giving absolute protection from wind, dust and rain. Ventilation is achieved by narrow slits in the sides and top of the car. Conforming to the shape of the body, the doors are curved, reaching so close to the ground that an eleven-inch step is all that is necessary to enter the car. Ample space is provided in the rear of the hollow body for baggage and the carrying of spare tires and other parts, while the seating arrangements allow each passenger more room than he would have in a modern limousine, and far more than in the various seven-passenger models of the present day. Wind resistance and the danger

Fig. 1.—Car built for the German Emperor in 1903. It had a rear entrance, proof that the problem of efficient mudguards and running boards had not yet been solved.

Fig. 2.—A car designed for the German Emperor in 1905. There are still unmistakable signs of the carriage maker's hand.

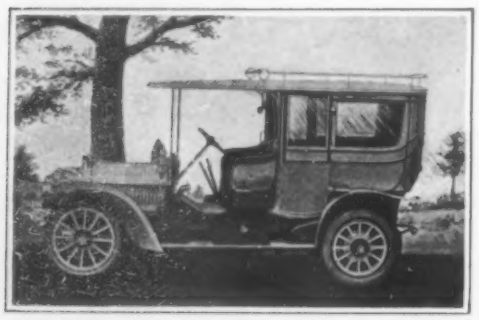


Fig. 3.—The German Emperor's 1907 car. Although it would not attract much attention to-day, the seat backs are stiff and vertical, the upholstery hard and thin. The driver has no protection.

Fig. 4.—A touring car of 1909.

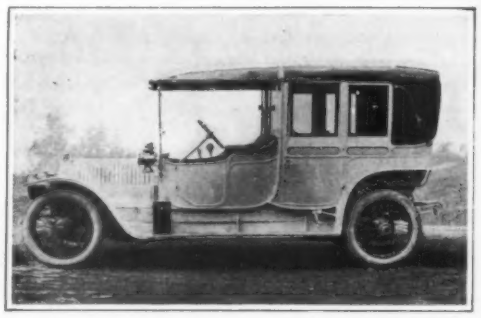


Fig. 5.—A splendid car built in 1910 for the President of France. Fore doors appear for the first time.

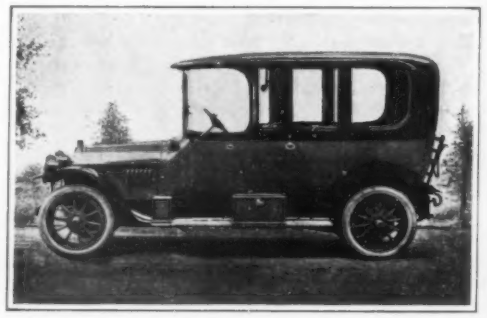


Fig. 6.—A 1912 model, which, were it not for the presence of the tool box in the very middle of the running board, might be considered more beautiful than the graceful car shown in Fig. 7.

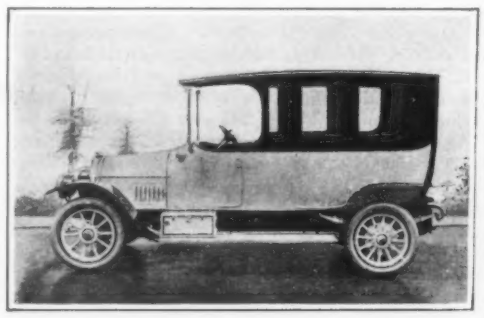


Fig. 7.—A 1913 German model, a good example of neat designing.

Fig. 8.—A 1905 American limousine.

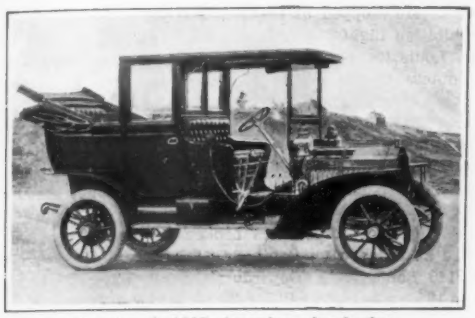


Fig. 9.—A 1907 American landaulet.

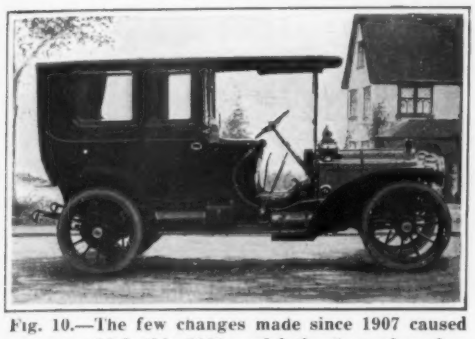


Fig. 10.—The few changes made since 1907 caused many to think this 1909 model the "car of perfection."

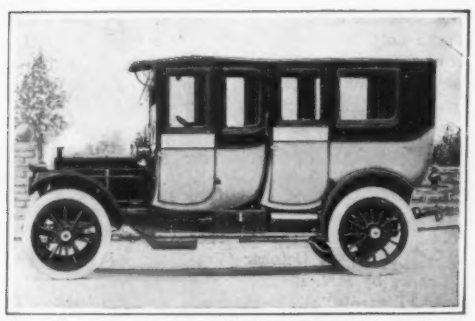


Fig. 11.—An American 1911 model which will not survive because of its peculiar broken appearance.

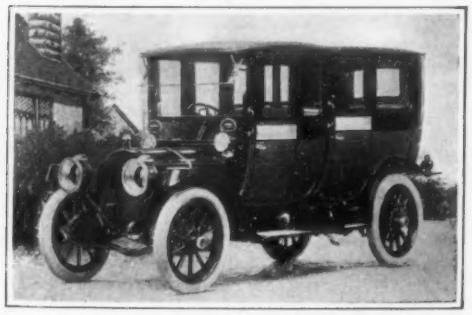


Fig. 12.—This type of 1912 is objectionable for the reason indicated in connection with Fig. 11.

Fig. 13.—A coupé type of 1913, which looks odd because the hood and dash-cowl combined are longer than the car body.

Fig. 14.—A so-called brougham, designed in America, in which it is difficult to pick flaws.

of skidding are reduced to a minimum in this design, and a number of racing cars constructed on these lines have proven that greater speed can be attained. The tendency toward "stream-line" bodies is clearly evident, although opinions differ as to the ultimate design which will be evolved. To assist the reader in forming his own opinion of what the car of the future will look like, I am showing herewith types of body construction in chronological order, from 1903 to 1913.

The cars shown in Figs. 1, 2, and 3 were made for the German emperor in 1903, 1905 and 1907, respectively, and therefore may be said to represent the best type of these years. The first two are "rear-entrance" cars, built in this manner chiefly for the reason that the problem of efficient mudguards and running boards had not yet been solved. They are clearly attempts at producing something comfortable and suitable for motor propulsion, and still suggestive of the carriage maker's hand in the design. The manufacturers of the chassis and motors were already striking out in new directions at that time, but the body-builders were still hampered by the traditions of the carriage industry.

Fig. 3 shows a car which resembles the machines of to-day. It could be driven down Broadway in New York city without causing sarcastic remarks among the pedestrians. But the backs of the seats are stiff and vertical, the upholstery is hard and thin and the driver has no protection from the elements and the dust.

The next illustration represents an immense step forward. It is a splendid car built in 1910 for the president of the French Republic by a firm which supplied Napoleon with his court carriages more than a century ago. It shows the fore-doors for the first time. When professional chauffeurs did the bulk of the driving of motor cars, no one gave much attention to their comfort and convenience, but as soon as the private owner began to drive the car himself, the necessity of doors for the front part of the car became evident. A comparison with the preceding photographs shows some of the most characteristic and pronounced tendencies of that year. The wheel-base has grown longer, the steering column is set at a more "rakish" angle, the steering wheel is larger in diameter, the running boards are free from unnecessary boxes and litter of all kinds, and the whole car has more sweeping and pleasing lines.

Particularly graceful are the lines of the huge limousine shown in Fig. 6. Were it not for the presence of the tool box in the very middle of the running board, it might be considered a more beautiful car than the graceful model represented by Fig. 7. The cars were built in 1912 and 1913, respectively—that is to say, they are the leading models of these years. The sweeping curve at the rear of the top in the 1912 model is undoubtedly more pleasing than the sharp edge of the following year's type, but the neat outlines of the mudguards and hood, the lower steering column and, especially, the clear running boards are advantages which the earlier model does not show.

The American automobile industry during those years kept fully abreast of its European rival. The same faults and drawbacks are noticeable in both, but there are also in evidence all the little improvements that were added abroad, in addition to some that were invented on this side of the Atlantic. But for the peculiar construction of the body of the 1911 model in Fig. 11, which makes it resemble two independent carriage bodies, stuck together as a sort of afterthought, there is no need of apology on this maker's part. The type is one which has a number of adherents, but which will not survive just on account of this peculiar "broken" appearance. In more exaggerated form it is shown in Fig. 16, which is a fine illustration of how an automobile body should *not* be designed. This style of construction is positively ugly—despite the fact that it may be comfortable and mechanically advantageous. The car also appears bigger than it really is, which may or may not be desirable, according to the opinion of the purchaser. The coupé type shown in Fig. 13 looks so odd chiefly on account of the extreme length of the hood, covering the six-cylinder motor; the hood and dash-cowl combined being longer than the entire body of the car.

It is difficult to pick flaws in the construction of the body shown in Fig. 14—a so-called brougham. The first view of this car impresses one with the immense power and speed possibilities lying within it, and subsequent closer examination only strengthens this first impression. It is a body design which is in no way inferior to anything produced in Europe, and shows the present high state of the industry in this country. The wheel-base of this car is practically thirteen feet.

An extraordinary European body construction is shown in Fig. 15. This type represents the latest idea in inclosing everything within the outer lines of the body, presenting a perfectly smooth exterior and greatly reduced wind resistance. Not only are the running boards absent, but the

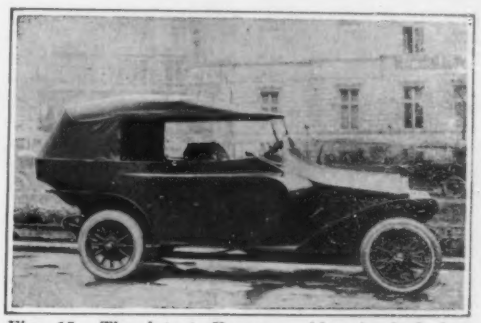


Fig. 15.—The latest European idea in inclosing everything within the outer lines. Complete protection is afforded to baggage, spare tires and tools.

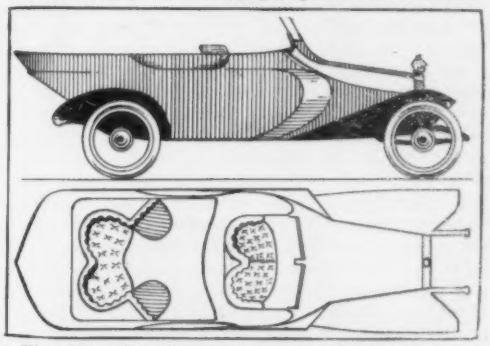


Fig. 15a.—Elevation and plan of car in Fig. 15.

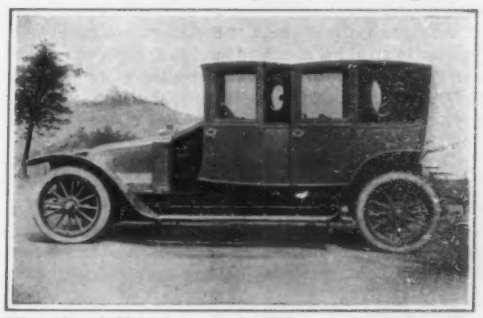


Fig. 16.—A French type of 1912, conspicuously ugly for its angles.

Fig. 17.—A modern French roadster in which an attempt is made to obtain smooth lines.

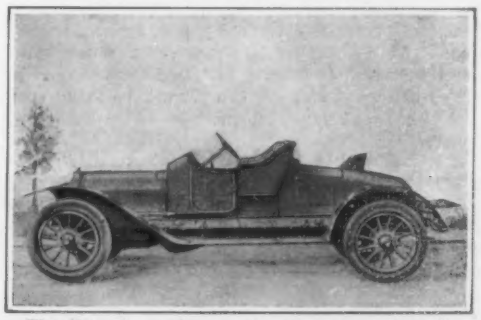


Fig. 18.—A good example of present French tendencies.

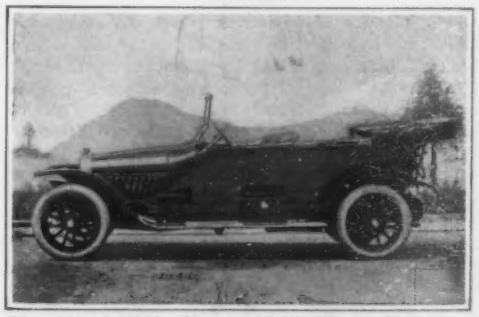


Fig. 19.—A 1912 phaeton which has a distinctive body suggesting speed and comfort.

body itself hangs over the wheels, giving plenty of room to the six passengers. The car is by all odds the most radical innovation in the line of body design, and from reports from abroad is expected to be placed in commission during the coming season by at least one prominent foreign maker. The car was shown built on an ordinary chassis at the last automobile show in Berlin, Germany, and created a veritable storm of discussion and criticism. It is the most comfortable design that has as yet been evolved, and the complete protection it affords to the baggage, spare tires, tool boxes, etc., is of great value to the long distance tourist.

French roadsters of peculiar shape are shown in Figs. 17 and 18, but a detailed description of their features is hardly necessary, as an examination of the illustrations will disclose their peculiarities.

The designing of bodies for motor cars is becoming more and more standardized. Only a few years ago body builders made a few special designs for each manufacturer, and there were hardly any two of them alike. Then, too, the customer, particularly abroad, used to purchase his own bodies, made according to his preferences and ideas. The best example of this is the made-to-order car which some time ago was built for a wealthy American lady, and which actually was measured so as to fit her figure as closely as possible. While other automobile purchasers were not quite so particular as to just how the body fitted them, they did express preferences which the body builder had to consider. As a result, a number of freak bodies are now roaming this country as well as Europe. In many instances their owners are heartily weary of looking at them.

A standardization in body design, therefore, is very desirable not only from an economical standpoint as also from the more altruistic one of beauty—as opposed to freakish contraptions. It is cheaper to build one thousand good automobile bodies after one and the same design than it is to build one thousand mediocre ones after the individual designs of one thousand persons. Besides, the metal body is driving out the wooden body, and it will not be long before the aluminium automobile body will reign supreme. In this country the use of metal bodies is increasing tremendously, and the greater ease of manufacture, cheapness and practical indestructibility make them favorites with manufacturers demanding large quantities of bodies.

Many of the automobile manufacturers make their own bodies, in this country at least, and there is naturally an increasing tendency on their part to specialize on a few popular designs instead of pleasing each customer individually. In Europe it is still the custom in most cases to sell the chassis alone, and have the customer order his own body attached. A much greater diversity among European cars is the result, and while this may appeal to some people it is decidedly uneconomical. At any rate, one must admit that a manufacturer who makes it his business to design automobile bodies knows better what would suit a customer than the latter himself.

The trend of the trade, if examined carefully, shows the preponderance of four types of cars, and by gradual elimination of the various freaks and semi-freaks produced annually these four types will be generally accepted as standard for all cars and by all manufacturers. They are: The inclosed coupé for two and four people; the limousine for five to seven people; the race-about or roadster for two people, and, finally, the open torpedo touring car for five to seven people. These four types cover the whole field, and until the actual arrival of the "car of the future" will be found sufficient to meet all requirements.

Aeronautics and Aviation in 1912

THE year 1912 has witnessed greater development in aerostation and aviation than any other year since the heavier-than-air machine was introduced. Both sciences have been put to active military use by most of the large nations, and several nations have used dirigibles and aeroplanes to good effect in real warfare. At the end of 1913 it is possible that we shall have to record battles in the air, just as last year there were several collisions, not all of which were fatal. At present guns for aeroplanes to use in attacking other aircraft are an established fact, one of the best of these being the invention of Lieut. Cleland Davis, U. S. A.; while Lieut. Riley W. Scott has perfected a bomb-dropping apparatus that leaves nothing to be desired, and has won with it the Michelin prize of $15,000. He stands ready to deliver his device to any War Department that wants it, and to instruct military aviators in its use. Lieut. Scott made a total of 8 out of 15 hits in dropping his projectiles from a height of 2,689 feet upon a 32.8-foot target.

The principal lines of aeroplane development last year were two—military and hydro-aeroplanes. England held a contest for military aeroplanes last fall like that held in France in 1911, while all the leading nations used aeroplanes in the annual maneuvers. At the close of the French maneuvers no less than 72 aeroplanes were reviewed by the Minister of War, and French pilots thought nothing of flying 350 miles a day during the war game. Flights totaling 43,000 miles were made in about a week's time. In the maneuvers in Connecticut and on the Pacific coast, Wright and Curtiss army biplanes were used. It was found possible to report to headquarters by wireless from a distance of 20 miles just what was occurring at the front. The chief difficulty experienced was the inability of the machines to carry two men—the first requisite of a military aeroplane.

After meeting with pronounced success the first of last year in the continuation of his hydro-aeroplane experiments at San Diego, Cal., Glenn Curtiss sent Hugh Robinson to the Monaco meet—the first hydro-aeroplane meet—in March. Robinson astonished the foreigners by his ability to navigate upon the open sea at Monaco. He had to compete only with a few other biplanes upon which floats had been hastily fitted. The result was that all Europe caught the "water plane" craze, and in the fall a number of hydro meets were held. At the Aero Club Show in the Grand Central Palace last May, Grover Cleveland Loening, the author of "Monoplanes and Biplanes," exhibited the first "flying boat," consisting of a monoplane, the body of which was watertight and formed a hull. He later made successful flights with this new craft. Donnet-Lévêque, in France, applied such a hull to a biplane in which André Beaumont flew from Paris to Boulogne over water.

Curtiss brought out a similar flying boat and our Navy has recently purchased one. The advantage of this type of hydro-aeroplane is that it can skim the surface of the water at 50 miles per hour and make 60 miles per hour a few feet above the surface without the least danger to the occupants. As many as four persons have made a trip of an hour or more in a French flying boat. There has been but a single fatal hydro-aeroplane accident, and that was due to foolhardiness, as mentioned in a recent issue. One of these machines gives the double pleasure of flying and motor boating with the dangers of the former entirely eliminated. Wheels may be fitted for land use as well, if desired.

Aerostation in America received a severe set-back early in July, through the bursting of what was practically her only dirigible. The "Akron" exploded early in the morning of July 2nd, while maneuvering above the shallow water of the inlet at Atlantic City. Melvin and Calvin Vanniman and the three other men that formed the "Akron's" gallant crew, fell to their deaths. Melvin Vanniman, since his attempt at crossing the Atlantic with Wellman in the "America," had given his entire energy to the accomplishment of this feat. Finally, securing the financial backing required, he had constructed the "Akron" for this purpose; but while building her he made an improvement which consisted of weaving wire in the cloth forming the gas bag, so that the completed envelope was wirewound like the barrel of a wirewound gun. The gas bag would thus be strong enough to withstand the increase in pressure arising from heating and consequent expansion of gas. The envelope of the "Akron" Vanniman thought was strong enough to withstand a considerably increased pressure, and it is believed he allowed the pressure to increase when the sun came from behind a cloud, with the result that a weak section of the envelope gave way.

An equally appalling aviation accident that occurred on July 1st was the flinging out of her 70 horse-power Blériot monoplane of Miss Harriet Quimby and W. A. P. Willard, at the Boston meet. Willard, who was some distance behind Miss Quimby, was flipped from his seat probably as the result of suddenly developed gyroscopic force, and Miss Quimby immediately followed him. Both fell a thousand feet into shallow water and were killed. Miss Quimby, shortly before, had won the honor of being the first and only aviatress to this day to fly across the English Channel. She used a 50 horse-power Blériot and made the flight from Dover to Calais in foggy weather. She landed at Hardelot 40 minutes after starting. Her accident at Boston would not have resulted fatally were two devices, which have since been perfected, been obtainable at that time. One of these is a gyroscope-compressed air automatic control for aeroplanes, which has been arranged to give automatic stability in all directions, and the other is a safety parachute of Japanese silk, weighing 6½ pounds, which is carried on an aviator's back like a knapsack and opens instantly when he is thrown out of his machine. Both are the inventions of Americans prominent in the electrical and aeronautic industries.

While there have been many long-distance aeroplane flights abroad, such as the 650-mile flight of Andemars in two days from Paris to Berlin, the only one of note in America was the 1,500-mile trip of Anthony Jannus from Omaha, Neb., to New Orleans in a Benoist hydro-aeroplane. Jannus' flying time was 31 hours 43 minutes. He stopped at many towns *en route*, and gave exhibition flights. The 471 miles from Kansas City to St. Louis were covered by Jannus alone in 9 hours 23 minutes, which is one fourth faster time than the express trains make. The 1,000 miles remaining were covered with a passenger and an 85-pound case of beer. The journey was made without any serious accident, the winding rivers being followed the entire distance. The replacements to plane and engine did not amount to $20.

All speed records were broken in the Bennett Cup race at Chicago on September 9th, when Vedrines, on a 140 horse-power Deperdussin "monocoque," covered the 124.8-mile course in 1 hour 10 minutes 57 seconds at the rate of 105½ miles per hour. He covered 10 kilometers in 3 minutes 27 3/5 seconds, or at a rate of 107.68 miles per hour. The American monoplane with 160 horse-power Gnome motor, built to defend the cup, was never flown.

As for the duration record, this was again raised by Fourny on a Maurice Farman biplane from 11 hours to 13 hours and 18 minutes on September 11th. A distance of 628 miles was covered over a 10-mile circular course. In America Lieut. John H. Towers, on October 6th, made an endurance record of 6 hours and 10 minutes with a 75 horse-power Curtiss hydro-aeroplane, while on October 31st Walter E. Johnson, at Bath, N. Y., carried a passenger for 3 hours 51¼ minutes with his Thomas biplane fitted with a 65 horse-power Kirkham 6-cylinder motor. The greatest total distance covered across country in a single day was the 570 miles between Valenciennes and Biarritz, traversed by Pierre Dancourt in his 50 horse-power Borel monoplane also on October 6th.

Three notable altitude flights were made the latter part of the year, two by Garros and one by Legagneaux. The record was raised each time 1,000 feet or more. Garros now holds it with 5,801 meters (19,032 feet), subject to revision. He made the record at Tunis and then flew to Sicily—160 miles oversea—and thence to Italy and Rome—a total distance of 700 miles. This was the most daring over-water flight since Lieut. Bague was lost.

The international balloon race started from Stuttgart, Germany, on October 27th. The race was won for France by MM. Bienaimé and Rumpelmayer in the balloon "Picardie." A landing was made near Moscow, and a new record of 1,364 miles was set up. Leblanc was second with 1,240 miles, and John Watts of St. Louis, third, with 1,000 miles.

The acquirement of aeroplanes by our Navy will probably be rapid from now on, since Capt. Charles deF. Chandler has invented a catapult, making it possible to successfully launch an aeroplane from the deck of a battleship. The Navy already has four hydro-aeroplanes, and one flying boat in addition to eight or ten biplanes possessed by the Army. Recent experiments with the Navy hydros have shown that submarines can be easily located when completely submerged even in rather muddy water. The wreck of the American warship "Philadelphia," which stranded off Tripoli in 1803, was recently discovered from an aeroplane.

Future biplanes purchased by the Government are all to have monoplane bodies of streamline form, bodies similar in many respects to that of the Benoist biplane used by Jannus. The twin-motored and duplicate twin-propellered Wright biplane which the late Howard W. Gill was to have flown in the Gould-SCIENTIFIC AMERICAN $15,000 two-motor prize contest on July 4th last, also had a body with aviator's seat therein. The above event was declared off as Mr. Gill was the only entrant ready to appear at the stated time and place. In England lately successful flights have been made with a two-motored biplane, and Grahame-White expects to fly to America in 30 hours next summer with a machine fitted with four motors of 250 horse-power each. The idea promulgated by Mr. Edwin Gould has, therefore, fructified.

Subsidizing the Motor Car

WITH a view of calling them out for mobilization, the French as well as the German government allows annual subsidies to owners of power wagons, provided these are of the approved types according to the War Department specifications. The leading constructors are now building their wagon trucks with this end in view, and this leads to a standardizing of the chassis as regards certain general sizes and other features, not interfering, however, with individual construction. The rules call for a 4-cylinder motor in all cases, and the preferred type carries about 3 tons load. Strict rules provide that the French cars shall be built entirely of home material. The 3-ton car receives a first subsidy known as purchase subsidy of $600 and an upkeep subsidy of $200 during 3 years following. In Germany the 5-ton wagon has subsidies of $1,000 and $250, respectively, for the same cases. Great Britain is now entering the movement, but the subsidies, $40 to $60, and $75 annual, are much smaller. Austria has a similar system.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Wanted: A Small Gasoline Plow

To the Editor of the SCIENTIFIC AMERICAN:

The above heading being made by one Mr. E. M. Blacksher, and answered from the standpoint of the owner and operator of a gasoline outfit of this sort in the December 7th issue of the SCIENTIFIC AMERICAN, I have a few suggestions to offer (being a student of mechanics in general) that might be useful.

Now, to get at the root of the thing: A small gasoline plow to be economical should essentially be light in weight and of corresponding small horse-power, so that fuel would not be too costly. But it must have as great tractive power as possible. Therefore, I believe that the novel traction wheel and tractor described in the SCIENTIFIC AMERICAN of September 7th, 1912, comes nearest solving the problem. It comes under the heading "Novel Italian Traction System."

Porterville, Cal. ALBIN A. ANDERSON.

The Gyroscopic Effect of Motors

To the Editor of the SCIENTIFIC AMERICAN:

In re this discussion as to the gyroscopic action of rotary motors, and especially as to aviators' experiences in the matter, the writer has come across the following footnote bearing on the question in a pamphlet entitled "Cantor Lectures on Aeronauties," by Charles Cyril Turner, being some lectures delivered before the Royal Society of Arts in 1910:

"It appeared subsequently, however, that with this rotating motor working at greater speed, it has a gyroscopic effect; and Delagrange, shortly before his fatal accident, told his friend, M. Gasnier, that it kept the machine so rigid that he found it almost impossible to alter his course by moving the elevating plane, and that in order to descend he had to slow the engine slightly. C. C. T."

It would appear that any danger due to the gyroscopic action of rotary motors—and also propellers—would exist only with very sudden changes of direction, such as might be caused sometimes by a sudden upward, downward or sidewise wind-gust striking only part of the aeroplane or different parts at different moments, and that the aviator would rarely if ever change the direction of movement suddenly enough to bring this gyroscopic force into dangerous play; for it is well known that gyroscopic force increases with the square of the speed with which the plane of rotation is changed.

It would also appear that gyroscopic force could be put to good use in steadying or even balancing a flying machine by producing a balanced effect with two or three sets of revolving motors—or motors and propellers—situated in both horizontal and vertical planes, each set consisting of two revolving in opposite directions, while one set of vertically revolving motors might extend fore and aft and the other transversely of the machine. It would be interesting, at least, to see these things tried.

Livermore, Cal. ELMER G. STILL.

The Gyroscopic Action of Gnome Engines

To the Editor of the SCIENTIFIC AMERICAN:

I should like to make a few remarks on Mr. Earle L. Ovington's letter published in your issue of December 7th on the death of Paul Peck and gyroscopic force in an aeroplane using an engine of the rotary type.

In his letter Mr. Ovington asks if anyone has ever heard of an aviator who has really had experience with a rotary motor complain about its gyroscopic action. Of course Mr. Peck is dead and it would be a very easy matter for anyone so desiring to credit statements to him which he might have or might not have made. Mr. Ovington makes the statement that it was a fact that Mr. Peck was never aware of any gyroscopic action. According to him, therefore, it must be so; but it might be a good idea to hear from another aviator on the same subject. A few days before Mr. Peck was killed Mr. John D. Cooper, licensed pilot No. 60, questioned him in regard to his motor, and especially in regard to any gyroscopic action that it might develop. Mr. Cooper had never flown with a rotary motor, but was considering the buying of one. Naturally he was desirous of learning all about them from an aviator who had had considerable experience with one.

Mr. Peck told Mr. Cooper that in making a turn he did feel the gyroscopic action of his motor, and especially if he was making a spiral. He said that in making the first turn he only felt the action slightly, but that in the second turn it was very strong, and that he seldom dared complete the third circle of the spiral. It was undoubtedly in making more turns than his judgement had heretofore advised him to make, owing to the gyroscopic action, that he lost control of his machine and the sad accident occurred which resulted in his death. For we all know that it was in making a spiral that he met his death, and that the machine never seemed to come out of its steep bank the least bit during its descent, even though Mr. Peck could be seen using his controls, trying to bring it back to a level position. There can be little doubt about the gyroscopic action, about which he had spoken only a few days previous, having been too much for the controls of the machine once its full force was felt.

I have every reason to believe Mr. Cooper's statement in regard to his interview with Mr. Peck.

I cannot blame Mr. Ovington for being so loyal to the type of motor that he has used most, for it is a poor kind of a sportsman who will not stand up for his favorite machine or motor, and especially when it has won as much for him as his, for we all know that he flew more miles in 1911 in a rotary-motored monoplane than any other pilot in the United States. I can only admire him for defending it so strongly, for its merits have been shown time and time again; but I fear that his arguments of late have been bordering very closely to narrowness, and he gives the impression that he is far from being open to conviction.

While I have not had a great deal of experience in flying with a rotary motor, I have made a number of flights in the most successful type of American-manufactured biplane, which happened to be equipped with one. I can truthfully state that I felt the gyroscope action whenever I made a turn with it, much more than I had ever felt it when using the stationary type of motor. And I can vouch for it that every student whom I instructed on that machine last winter in California will say the same thing of it. I am not foolish enough to ever think of knocking the rotary motor, for the wonderful records which have been made with it stand out as a glorious monument to its design. I simply state that there is a gyroscopic action when it is used, and this is far from being negligible in practice.

Hammondsport, N. Y. JOHN LANSING COLLAN,
Licensed pilot No. 102, F.A.I.

[The Editor can publish no more letters on this subject.]

Control of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN:

In the December 7th number of the SCIENTIFIC AMERICAN there was published a letter by Mr. N. J. Noble concerning the control of the floods of the Mississippi River. Mr. Noble suggests as a remedy "the construction of reservoirs in the upper courses and tributaries, in the case of the Mississippi the numerous tributaries of the Missouri in particular."

Possibly in the case of the Missouri Mr. Noble's plan may be of some merit, but the contrary most certainly appears to be the case with the Mississippi itself. Close to the head waters of the Mississippi in northern Minnesota, at Leech, Winnibigoshish, and Pokegama lakes, the United States War Department has already constructed three large concrete dams, forming reservoirs many square miles in extent in the lakes and swamps through which the river passes. These dams have been completed and in operation for several years, quite a sufficient time to demonstrate their value in the control of floods, but the results obtained in that direction are very doubtful, so doubtful in fact that there has been serious complaint from people living on the lower lands along the river for at least three hundred miles below the dams, that their presence increases rather than decreases floods.

One reason that a system of reservoirs does not control floods seems to be that the straw that breaks the camel's back, the extra water that causes the flood, comes on top of reservoirs already filled by a long wet season or by the annual spring freshet. It is not the unusual annual freshet that causes floods, but any unusual fall coming on top of this.

This has been shown by the reports of experts who have investigated the influence of a forested watershed on stream flow as compared with a non-forested one. The forest floor acts as an enormous reservoir, absorbing and retarding for a considerable period large amounts of water, and thereby regulating stream flow and lessening the volume of many small freshets. The authorities usually agree, however, that the ultimate high-water mark attained by the stream is not lowered by the presence of the forest, for the excess water that causes the serious flood always comes on top of a forest floor already saturated, a reservoir already filled; the result is quite as much run off as though the forest floor or the reservoir did not exist.

Mr. Noble suggests that by reference to our geographies we may learn that "certain characteristics and facts pertain to all of that large class of rivers of which the Mississippi is one, namely, that these rivers have their rise in hilly or mountainous countries." If he will turn to any good contour map of Minnesota, or of the United States, he may be surprised to learn that the Mississippi does not rise in a mountainous or hilly country, but instead rises and flows for miles through a country of very slight relief and with an absolute elevation of only about 1,600 feet above sea level. The result is that the reservoirs overflow several thousand acres of low-lying land, which they convert into festering mosquito-breeding swamps in summer and impassable tangles of prostrate water-killed timber in winter. The lakes converted into reservoirs, instead of being a "thing of beauty and a joy forever," as nature made them, have their natural shore lines spoiled and in many places made inaccessible and their waters polluted with green algæ and pond scum as a result of the widely shifting level and the thousands of acres of now submerged and now exposed flowage, which is caused by manipulating the gates of the dams to control the flow of water.

Perhaps the Mississippi can be controlled by a system of dams, but results so far obtained in Minnesota seem decidedly to point to the contrary. H. R. FLINT,

Osakis, Minn.

The Inventor and His Reward

To the Editor of the SCIENTIFIC AMERICAN:

As an inventor I am gratified at the firm stand you have taken for the protection of the inventor's rights in the discussion of the patent bill now before Congress, and you certainly have justice on your side. Article I, Section 8, of the Constitution says (par. 8): "The Congress shall have power to promote the progress of science and the useful arts by securing for limited times to authors and inventors the *exclusive* rights to their respective writings and discoveries."

The word "exclusive" would seem to be broad enough to cover every point at issue, and would certainly cover the fixing of price and sales conditions by the inventor. "Exclusive" certainly implies a monoply, and nowhere in the Constitution is Congress given power to abridge this grant other than by limiting the time it may run; and I am satisfied that the Supreme Court will take this view of the matter, in case the proposed bill should be passed.

The wisdom of the framers of the Constitution in recognizing the rights of authors and inventors is amply proved by the history of industry in this country.

The present stupendous wealth and prosperity of this country is due solely to its inventors. This seems a strong statement to make, but it is easy to prove its truth.

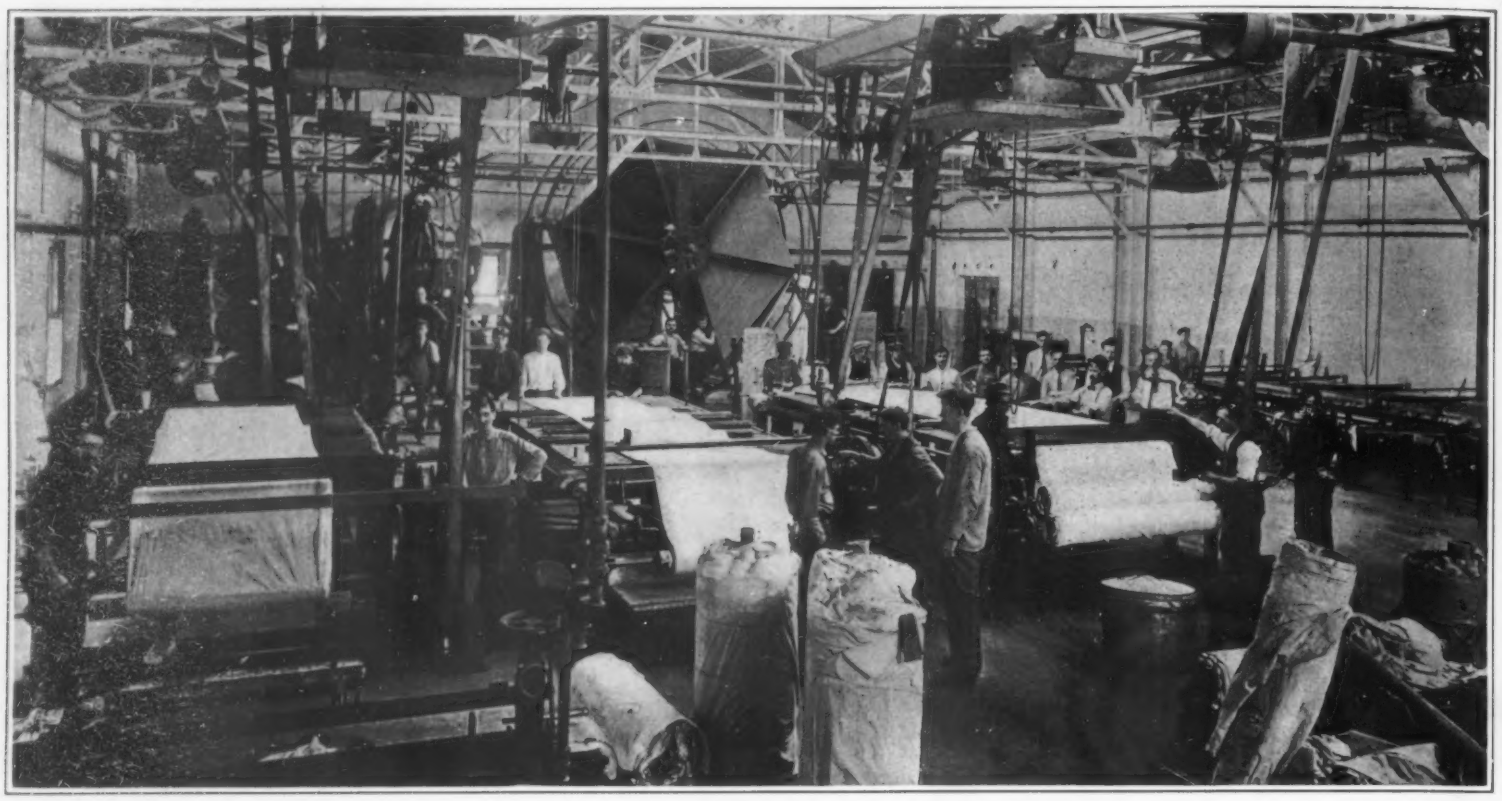
The vast resources have existed since prehistoric times, but their present utilization has been possible only through the work of the inventor. The cotton gin made cotton a profitable crop, the steamboat and the railroad made it possible to raise it in the interior, and it has gone on increasing until this year Texas alone raised $300,000,000 of cotton. The railroad, while first tried in England, was first proposed by an American inventor and first brought to perfection here as a freight carrier. The steamboat was distinctly American. Agricultural machinery was the product of this country, and without it the middle West would still be "The Great American Desert," as it was once called. Here intensive farming will not pay on account of scanty rainfall, but extensive farming will; and one man can with the present labor-saving machinery farm as much as twenty men could by hand, and do it better. The Secretary of Agriculture estimates this year's farm products at nearly ten billion dollars. How much would it have been without the American inventor? What per cent of this enormous sum goes to him for his inventions?

John Deere, who invented the modern plow; McCormick with the reaper, Appleby with his twine binder, are dead; their profits have long since ceased, but the country is still reaping the benefits. Was the exclusive right to their inventions an injury? Goodyear struggled for years, in poverty and failure, with splendid courage and hope, to make a useful product from the useless raw rubber. His ultimate success and the right for seventeen years to control his invention was a small reward for his long struggle. The Government could not give him back his time, it could not return his youth; all it could do was to secure his rights for a few years. Was this an injustice to the public? Of what account was his profit in the first years of the industry compared to the comforts and conveniences to which his invention gave birth? And his story is but one; there are many others, most of them obscure, who labored no less diligently to improve conditions and appliances of mankind, many like him confronted for years by poverty and bitter failure, made still more bitter by the jeers of those they were striving to benefit.

Is it any more than simple justice that they should be enabled to reap a monetary reward for the fruits of their labor? As you say, they have created something which did not previously exist, and which would not have existed but for their efforts, and in which their right supersedes that of the public. On the other hand, the first years of the life of an inventor are the least profitable, and infringers frequently destroy what profit there is. The case of the Wright brothers is pertinent. They risked their lives in making flying a success, and have been engaged in expensive litigation since the issue of their patents, to secure the rights and profits which were rightfully theirs.

Instead of detracting from the value and profits of an inventor, it would seem more worthy for Congress to secure the inventor more fully in his constitutional rights.

Omaha, Neb. L. W. SMITH.



The spreader room of a rubber factory.

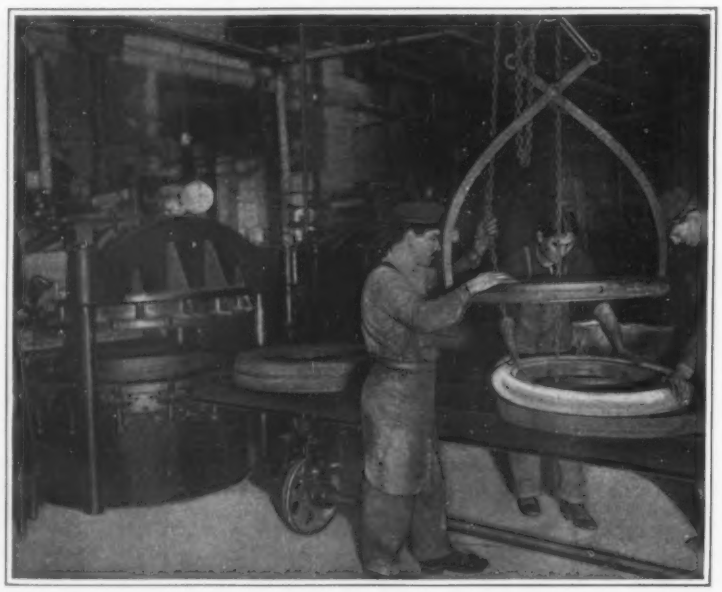
The Making of a Pneumatic Automobile Tire

A Trip Through a Tire Factory

By E. R. Hall

CRUDE rubber never reaches the manufacturer clean. Before it can be converted into a tire it must be washed. First, it is cut up into small pieces, put into large vats of warmed water and allowed to soak in order to soften it sufficiently to be broken down in the machines. By means of a cracker, a machine consisting of two rolls with projections on their surfaces shaped like little pyramids, the two rolls revolving with a differential, one going considerably faster than the other, and being adjustable so that they can work close together or with some distance between them, the rubber is broken down into a coarse, spongy mass. Water flows on to the rubber during the process, bringing down sand, dirt, bark, and the many other foreign materials which come mixed with the rubber. The rubber is put through this machine a number of times until it is worked into a uniform condition. Some of the rubbers, like the Ceylons and Paras, will sheet out into a coarse sheet by being put through this machine; others, like the majority of the African rubbers, will fall apart and come down in chunks and have to be fed into the machine with a shovel.

After the rubber is broken down sufficiently in the cracker, it is next put through a washing machine, built like a cracker, except that the rolls are grooved or rifled, so that their action is not so severe. Water constantly runs over this machine, and the rolls work very close together, so that the rubber is finely ground and run out into a thin and comparatively smooth sheet, allowing the water flowing between the rolls to take out practically all of the foreign matter that remains. Some types of rubber, such as Manicoba, which have large quantities of sand in them, are washed in a special form of washing machine known as the beater washer—an endless, oval-shaped trough with a fast-revolving paddle wheel. In this machine the rubber is submerged in water, after being broken down in the cracker, and the sand is literally knocked out of it by the paddle wheel. The sand drops to the bottom of the machine, where it is drained off, while the rubber floats to the top to be gathered and then put through a regular washing machine for the final sheeting out.



Mounting the partially cured tire on a rim preparatory to final vulcanization in inflated form.

Machine for cutting the fabric into bias strips.

How the Rubber is Dried.

Before the rubber can be used in any articles of commercial value, it must be thoroughly dried. Any moisture in the stock would turn to steam during the vulcanizing process and give rise to blisters or blow-holes in the goods. There are two ways in which rubber is usually dried. The method mostly used and generally practised with all the better grades of gums, is to hang the washed strips on horizontal poles and space them in aisles, so that air may freely circulate around the surface of the rubber, the dry room being kept at a constant temperature. To dry the rubbers properly by this method takes from four to six weeks.

The other method is vacuum drying. Low-grade rubbers which have a comparatively large percentage of resin in their composition cannot bear their own weight when hung on horizontal poles, but drop off. Hence, these rubbers have to be dried in a peculiar manner. They are laid in trays which are placed into a large air-tight receptacle. Then the air is withdrawn and the interior heated by means of steam coils. Thus the water is evaporated from the rubber at a considerably lower temperature than that at which water boils under atmospheric pressure, and at such a low temperature, and in such a short time, that the rubber is not affected. By this process, these rubbers can be dried in a few hours.

Ingredients and Their Purpose.

After having been thoroughly dried, the rubber is ready to be mixed in proper proportions with the various ingredients, which give the desired quality for various products. In order that rubber shall vulcanize, it is necessary to mix with it a certain proportion of sulphur, vulcanizing, or curing, as it is sometimes called, being merely the changing of a physical mixture of rubber and sulphur into a chemical

Applying the tread.

Arranging fabric on tire-building machine.

The wrapping room of a pneumatic tire plant.

compound of these ingredients, by the application of heat. Besides sulphur, some of the more important ingredients used in compounding rubber are:

Zinc Oxide: This toughens the rubber and increases its wearing properties and tensile strength.

Barium Sulphate: This stiffens the rubber and adds weight, so reducing the cost.

Lithopone: This whitens the stock and makes it soft, and is used extensively in druggists' sundries.

Antimony Sulphide: This makes the stock red and is a preservative against oxidation.

Litharge: This has the same action as antimony sulphide, but makes the stock black.

White Lead: This hastens the cure and is extensively used in gray and black stocks, and is a good filler or weight adder.

Magnesia Oxide and Carbonate: These are used as fillers for white stocks.

Oxide of Iron: Used for coloring red and yellow stocks.

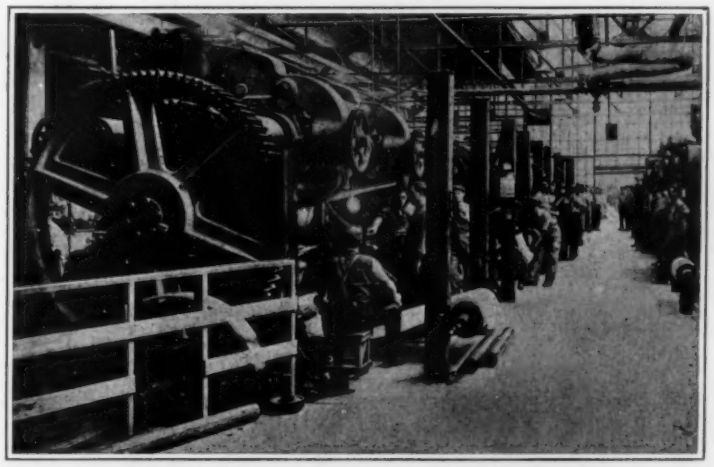
Lime (unslaked): This hastens vulcanization and chemically removes any water left in the rubber.

Whiting: This is used only as a cheap filler to increase quantity and lower cost.

Aluminium Silicate: This is used chiefly as a filler.

The various ingredients mixed with rubber are not put into the compounds merely to cheapen the product and to lower the grade of the material. While true of molded goods, rubber heels, bicycle grips, automobile bumpers, etc., it is not true of tires, packing, belting, etc. Ingredients are added in the case of tires to toughen the gum, increase its wearing qualities, to make it indestructible when subjected to heat, or to make it soft and yielding so that it can be forced into fabric, etc.

Finishing pneumatic automobile tires.



Room where the compounded rubber is put through calenders.

In the general process of manufacture, the sheeted rubber is sent directly from the dry room to the compound room where the various ingredients are weighed out into proper proportions along with the rubber to make up a batch, and placed in receptacles ready to be mixed. The batch is then sent into the mill room to be mixed into a uniform pasty mass, which is the characteristic uncured, or so-called green, rubber compound. The mixing is done in the mill, a very heavy machine, resembling a cracker and a washer, except that it is much larger and heavier, and that the rolls are perfectly smooth and run closer together. No water at all is used on the batch during the mixing.

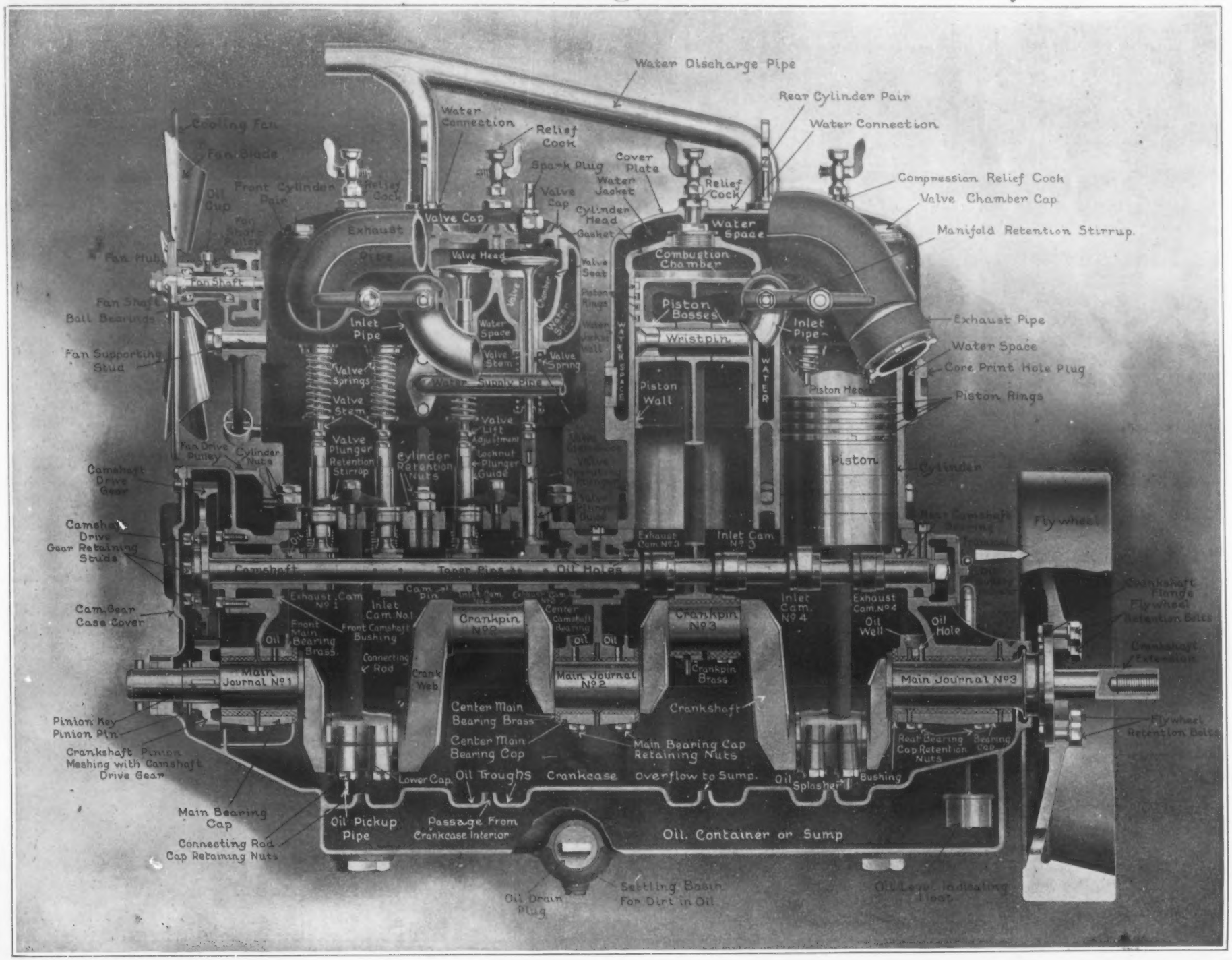
After the batch is properly mixed, it is cut off the rolls in sheets and rolled up and sent to the green-stock storeroom. In this storeroom the compounded, uncured gums are kept in different bins, according to the nature of the compound, and are there allowed to season a certain length of time, after which they are delivered to the various departments of the factory in which they are to be used.

Another form in which rubber is used is the so-called rubber cement. Rubber or any of its compounds are readily soluble in naphtha. In this process, the compounds, after being milled, are macerated in specially constructed cement mills and there mixed with a certain proportion of naphtha which gives a thick solution.

(Continued on page 51.)

Single cure process: The whole tire vulcanized after the tread has been applied.

Location of Gasoline Engine Troubles Made Easy



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A Comprehensive Exposition of the Common Derangements That Interfere With Efficient Operation of All Types of Four-Cycle Internal Combustion Motors

Tables compiled by Victor W. Page, M.E., author of "The Modern Gasoline Automobile."

INSTRUCTIONS FOR USE

This chart has been prepared to outline in a simple manner the various troubles and derangements that interfere with efficient internal combustion engine action. While the form illustrated is a type used as a motor-car power plant, the parts and their functions are practically the same in all gas or gasoline engines of the four-cycle type, and the general instructions given apply just as well to all hydro-carbon engines, even if the parts differ in form materially. The essential components are clearly indicated in the part sectional drawing so they may be easily recognized. The various defects that may materialize are tabulated in a manner that makes for ready reference, and the various defective conditions are found opposite the part affected, and under a heading that denotes the main trouble to which the others are contributing causes. The various symptoms denoting the individual troubles outlined are given to facilitate their recognition in a positive manner.

Brief note is also made of the remedies for the restoration of the defective part or condition. It is apparent that a chart of this character is intended merely as a guide, and it is a compilation of practically all the known troubles that may materialize in gas-engine operation. While most of the defects outlined are common enough to warrant suspicion, they will never exist in an engine all at the same time, and it will be necessary to make a systematic search for such of those as exist.

To use the chart advantageously, it is necessary to know one main trouble easily recognized. For example, if the power plant is noisy, look for the possible troubles under the head of Noisy Operation; if it lacks capacity, the derangement will undoubtedly be found under the head of Lost Power. It is assumed in all cases that the trouble exists in the power plant or its components, and not in the auxiliary members of the ignition, carburetion, lubrication, or cooling systems. The novice motorist and student will readily recognize the parts of the average engine by referring to the very completely outlined and clearly lettered mechanism in the illustration.

"SKIPPING" OR IRREGULAR OPERATION

PART AFFECTED.	NATURE OF TROUBLE.	SYMPTOMS AND EFFECTS.	REMEDY.
Compression Relief Cock.	Leak in threads or spigot.	Dilutes mixture with air, causes blowback.	Screw down tighter. Grind spigot to seat with emery.
Spark Plug.	Leak in threads. Defective gasket. Cracked insulator. Points too near. Points covered with carbon. Too much air gap.	Dilutes mixture. Allows short circuit. No spark.	Screw down tighter. Replace with new. Set points 1-64" apart for magneto, 1-32" for battery spark.
Valve Chamber Cap.	Leak in threads. Defective gasket.	Dilutes mixture by allowing air to enter cylinder on suction stroke.	Previously given.
Combustion Chamber.	Carbon deposits.	Preignition.	Scrape out.
Valve Head.	Warped or pitted. Loose on stem.	Dilutes charge with poor air or gas.	Previously given.
Valve stem.	Binding in guide. Sticking.	Irregular valve action.	Previously given.
Valve Seat.	Scored or warped. Cracked. Covered with scale. Dirt under valve.	Gas leak, poor mixture. Poor compression. Valve will not close.	" "
Induction Pipe.	Leak at joints. Crack or blowhole.	Mixture diluted with excess air.	Stop all leaks.
Inlet Valve.	Closes too late. Opens too early.	Blowback in carburetor.	Time properly.
Exhaust Valve.	Opens too late. Closes too early.	Retention of burnt gas dilutes charge.	Time properly.
Valve Stem Guide.	Bent or carbonized.	Causes valve to stick.	Previously given.
Inlet Valve Stem Guide.	Worn, stem loose.	Air drawn in on suction thins gas.	Bush guide or use new member.
Valve Spring.	Weakened or broken.	Irregular action.	Use new spring.
Valve Stem Clearance	Too little. Too much.	Valve will not shut. Valve opens late, closes early.	Adjust gap .005" inlet, .008" exhaust.
Valve Spring Collar Key.	Broken.	Releases spring.	Replace.
Cam.	Worn cam contour. Loose on shaft. Out of time.	Valve lift reduced. Does not lift valve. Valves operate at wrong time.	Previously given.
Camshaft Bearing.	Looseness or wear.	Valve timing altered. Valve lift decreased.	Replace.
Camshaft.	Twisted.	Valves out of time.	Previously given.
Cam Fastening.	Worn or broken.	Valve action irregular.	Replace with new.
Valve Operating Plunger.	Loose in guide.	Alters valve timing.	Replace with new.
Valve Plunger Guide.	Wear in bore. Loose on engine base.	Alters valve timing.	Replace or bush. Fasten securely.
Timing Gears.	Not properly meshed. Loose on shaft.	Valves out of time. Valves do not operate.	Retime properly. Fasten to shaft.
Piston.	Walls scored.	Leakage of gas.	Smooth up if possible.
Piston Head.	Carbon deposits. Crack or blowhole (rare).	Cause premature ignition.	Previously given.
Piston Rings.	No spring. Loose in grooves. Worn or broken.	Leakage weakens suction.	" "
Cylinder Wall.	Scored by wristpin. Scored by lack of oil.	Gas leaks by. Poor suction	" "

LOST POWER AND OVERHEATING

PART AFFECTED.	NATURE OF TROUBLE.	SYMPTOMS AND EFFECTS.	REMEDY.
Water Pipe Joint.	Loose.	Loss of water, heating.	Tighten bolts, replace gasket.
Spark Plug.	Leakage in threads, insulation, or packing.	Loss of power. Hissing caused by escaping gas.	Replace insulation if defective, screw down tighter.
Compression Release Cock.	Leak in threads. Leak in fitting.	Loss of power. Whistling or hissing.	Tighten if loose. Grind fitting to new seating in body.
Combustion Chamber.	Crack or blowhole. Roughness. Carbon deposits. Sharp edges.	Loss of compression. Preignition.	Fill by welding. Smooth out roughness. Scrape out or dissolve carbon.
Valve Chamber Cap.	Leak in threads. Defective gasket.	Loss of compression. Hissing.	Remove. Apply pipe compound to threads and replace. Use new gasket or packing.
Valve Head.	Warped. Scored or pitted. Carbonized. Covered with scale. Loose on stem (two-piece valves only).	Loss of compression.	True up in lathe. Grind to seat. Scrape off. Smooth with emery cloth. Tighten by rivetting.
Valve Seat.	Warped or pitted. Covered with carbon. Foreign matter between valve and seat.	Loss of compression.	Use reseating reamer. Clean off and grind valve to seat.
Valve Stem.	Covered with scale. Bent. Binding in guide. Stuck in guide.	Valve does not close. Loss of compression.	Clean with emery cloth, straighten. True up and smooth off, free with kerosene.
Valve Stem Guide.	Burnt or rough. Loose in valve chamber.	Valve may stick. Action irregular.	Clean out hole. Screw in tighter.
Valve Spring.	Weak or broken.	Valve does not close.	Replace with new.
Valve Operating Plunger.	Loose in guide. Too much clearance between valve stem.	Valve action poor. Lift insufficient.	Replace with new. Adjust screw closer.
Valve Lift Adjusting Screw.	Threads stripped. Too near valve. Too far from valve.	Poor valve action.	Replace with new. Adjust with proper reference to valve stem.
Valve Lift Cam.	Worn cam contour. Loose on shaft. Out of time.	Not enough valve lift. Will not lift valve. Valve opens at wrong time.	Replace with new. Replace pins or keys. Set to open properly.
Camshaft.	Sprung or twisted.	Valves out of time.	Straighten.
Camshaft Bushing.	Worn.	Not enough valve lift.	Replace.
Camshaft Drive Gear.	Loose on shaft. Out of time. Worn or broken teeth.	Irregular valve action.	Fasten securely. Time properly. Replace with new.
Cam Fastenings.	Worn or broken.	Valves out of time.	Replace with new.
Cylinder Wall.	Scored, gas leaks. Poor lubrication causes friction.	Poor compression. Overheating.	Grind out bore. Repair oiling system.
Piston.	Binds in cylinder. Walls scored. Worn out of round.	Overheating. Poor compression.	Lap off excess metal. Replace with new.
Piston Rings.	Loss of spring. Loose in grooves. Scored. Worn or broken. Slots in line.	Loss of compression. Gas blows by.	Peen ring or replace. Fit new rings. Grind smooth. Replace. Turn slots apart.
	Carbon in grooves. Insufficient opening. Binding on cylinder.	Overheating because of friction.	Remove deposits. File slot. Grind or lap to fit cylinder bore.
Wristpin.	Loose, scores cylinder.	Loss of compression.	Fasten securely. Replace cylinder if groove is deep.
Crankshaft.	Scored or rough on journals. Sprung.	Overheating because of friction.	Smooth up. Straighten.
Crank Bearings. Main Bearings.	Adjusted too tight. Defective oiling. Brasses burned.	Overheating because of friction.	Adjust freely, clean out oil holes and enlarge oil grooves.
Oil Sump.	Insufficient oil. Poor lubricant. Dirty oil.	Overheating.	Replenish supply. Use best oil. Wash out with kerosene, put in clean oil.
Water Space. Water Pipes.	Clogged with sediment or scale.	Overheating.	Dissolve foreign matter and remove.
Fan Belt.	Loose or broken.	Overheating.	Adjust or replace.
Piston Head.	Cracked (rare). Carbon deposits.	Loss of compression. Preignition.	Weld by autogenous process. Scrape off carbon accumulations.

NOISY OPERATION OF POWER PLANT

PART AFFECTED.	NATURE OF TROUBLE.	CHARACTER OF NOISE.	REMEDY.
Compression Release Cock.	Leakage.	Hissing.	Previously given.
Spark Plug.	Leakage.	Hissing.	" "
Valve Chamber Cap.	Leakage.	Hiss or whistle.	" "
Combustion Chamber.	Carbon deposits.	Knocking.	" "
Inlet Valve Seat.	Defects previously given.	Popping in carburetor.	" "
Valve Head.	Loose on stem.	Clicking.	" "
Valve Stem. Valve Stem Guide.	Wear or looseness.	Rattle or clicking.	" "
Inlet Valve.	Closes too late. Opens too early.	Blowback in carburetor.	" "
Valve Spring.	Weak or broken.	Blowback in carburetor.	" "
Cylinder Casting.	Retaining bolts loose. Piston strikes at upper end.	Sharp metallic knock.	Tighten bolts. Round edges of piston top.
Cylinder Wall.	Scored.	Hissing.	Previously given.
Valve Stem Clearance.	Too much. Too little (inlet valve).	Clicking. Blowback in carburetor.	" "
Valve Operating Plunger. Plunger Guide.	Looseness.	Rattle or clicking.	" "
Timing Gears.	Loose on fastenings. Worn teeth. Meshed too deeply.	Metallic knock. Rattle. Grinding.	" "
Cylinder or Piston.	No oil or poor lubricant.	Grinding.	Repair oil system.
Cam	Loose on shaft. Worn contour.	Metallic knock.	Previously given.
Camshaft Bearing	Looseness or wear.	Slight knock.	" "
Cam Fastening.	Looseness.	Clicking.	" "
Piston.	Binding in cylinder. Worn oval, causes side slap in cylinder.	Grinding or dull squeak. Dull hammering.	" "
Piston Head.	Carbon deposits.	Knocking.	" "
Piston Rings.	Defective oiling. Leakage. Binding in cylinder.	Squeaking. Hissing. Grinding.	" "
Wristpin.	Loose in piston. Worn.	Dull metallic knock.	Replace with new member.
Connecting Rod.	Wear in upper bushing. Wear at crankpin. Side play in piston.	Distinct knock.	Adjust or replace. Scrape and fit. Use longer wristpin bushing.
Crank Bearings.	Looseness. Excessive end play. Binding, fitted too tight.	Metallic knock. Intermittent knock. Squeaking.	Refit bearings. Longer bushings needed. Insert shims to allow more play.
Main Bearings.	Looseness. Defective lubrication.	Metallic knock. Squeaking.	Fit brasses closer to shaft. Clean out oil holes and grooves.
Connecting Rod Bolts. Main Bearing Bolts.	Loose.	Sharp knock.	Tighten.
Crankshaft.	Defective oiling.	Squeaking.	Previously given.
Engine Base.	Loose on frame.	Sharp pounding.	Tighten bolts.
Lower Half Crankcase.	Bolts loose.	Knocking.	Tighten bolts.
Flywheel.	Loose on crankshaft.	Very sharp knock.	Tighten retention bolts or fit new keys.
Oil Sump.	Oil level too low. Poor lubricant.	Grinding and squeak in all bearings.	Replenish with best cylinder oil.
Valve Plunger Retention Stirrups.	Looseness.	Clicking.	Tighten nuts.
Fan.	Blade loose. Blade strikes cooler.	Clicking or rattle.	Tighten. Bend back.
Fan Hub Bearings.	Broken ball.	Clicking.	Put in new ball.
Induction Pipe Joints.	Leakage.	Sharp whistle.	Use new gasket.
Exhaust Pipe Joints.	Leakage.	Sharp hissing.	Tighten or use new gasket.
Crankcase Packing	Leakage.	Blowing sound.	Use new packing. Tighten bolts.
Water Pipe.	Leaks. Loss of water. Clogged with sediment.	Pounding because engine heats.	Previously given.
Water Jacket.	Clogged with sediment. Walls covered with scale.	Knocking because engine heats.	Dissolve scale and flush out water space with water under pressure.

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The Riviera Gateway between France and Italy (Menton-Vintimiglia).

Europe's Good Roads

What They Mean to Road Users

By Francis Miltoun

This article is a review of the best road engineering practice of Europe. While there are just as good roads in the United States to-day as in France, for example, our mileage of good roads is hopelessly outdistanced by the corresponding mileage of European countries that cannot compare with us in population or in national wealth. As a matter of business itself, the good roads question is one of the biggest on the economic horizon to-day. Americans should know how Europe is endeavoring to solve that problem. This article will tell them.—EDITOR.

Broad flat flagstones mark the through routes passing through Italian towns.

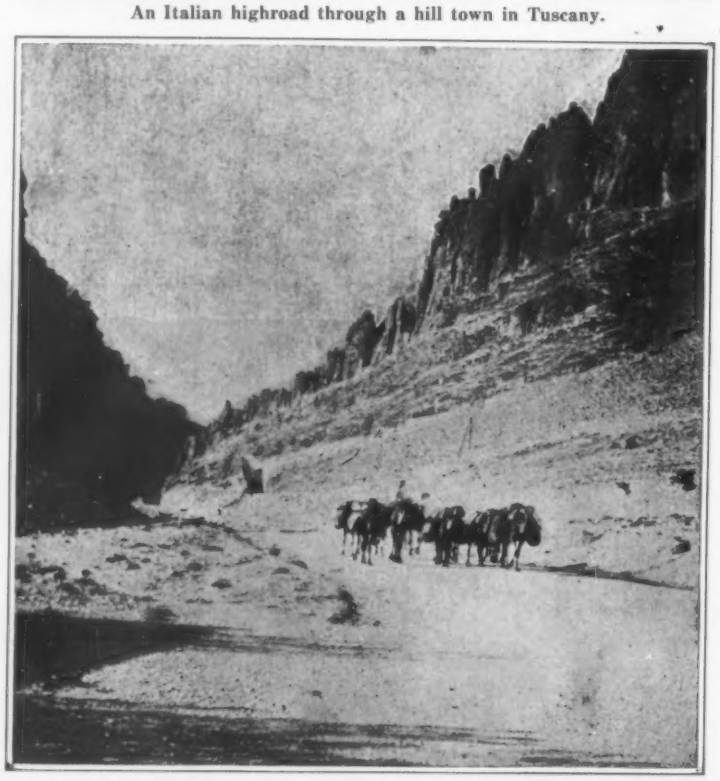
IT is no retrograde movement that proclaims comfortable travel by road as one of those twentieth century blessings which is our due. It is an axiom that the speedy railway development of the United States worked to the detriment and discouragement of scientific road building. Old Europe suffered under no such handicap. Roads, more or less acceptible were there. Take the case of France as the conclusive, concrete example, because France has the greatest continuity and excellence of good roads to-day—since the Roman invasion, a fact which is evinced by one of the celebrated *bornes millières*—the mile stones of the Roman era—which sits beside a tree-bordered Route Nationale not a stone's throw from where these lines are written. The roads of Gaul were planned on grand lines; their great scope even at this late day cannot be denied and proves that they are a tangible expression of planning for the future. French roads of to-day follow these same general lines. It is thus that Europe got her start. What is more remarkable, France, through the application of the same nation-wide governmental and centralized roads control system, has endowed Algeria (in something less than three quarters of a century) with highways as good as those of the mainland itself. It is not solely then because a country is new that its roads should have been ignored or neglected—not even on the insistence of big business, for as a matter of business itself the good roads question is one of the biggest on the economic horizon to-day.

The Influence of the Romans.

All this has for long been recognized in France and her famous Ecole des Ponts et Chaussées (which gave the inspiration for the establishing of the highway engineering chair at Columbia University) turns out its road engineers all trained to the same methods. This of itself produces a uniformity of design and treatment which has done much toward putting French roads into the enviable class in which they stand. If a further endorsement of this paternalism were needed it can only be added that the recently founded department of the government, the *Office National de Tourisme*, is working hand in hand with the road building authorities for the provision of the funds necessary to build new roads which shall open up many hitherto closed regions to a rapidly increasing tourist traffic. This is not by any means an idle catering to the classes of leisure, the spenders; the development of a hitherto inaccessible region to tourists means that all the allied interests, which may previously have languished, will at least become producers able to furnish a more comfortable livelihood for many a mountain community which hitherto eked out but a perilous existence or emigrated to the shores of the Seven Seas. It was this combined effort of two friendly governmental departments which brought into being the magnificent *Route des Alpes* from Lake Leman to the Mediterranean—five hundred miles of superb mountain roadway through the Alps of Savoy and Dauphiny—and which in a like manner is achieving the *Route des Pyrénées* from the Bay of Biscay to the Mediterranean. The famous *Corniche d'Or* of the Esterels, too, a magnificent forty kilometer stretch of shelf-like, cliffside Mediterranean, bordering the Riviera, just before Cannes, owes its existence to a like initiative. Formerly it was but a coast-guard's trail; to-day it is the most beautifully disposed and most remarkably engineered roadway extant.

On a Swiss mountain road.

An Italian highroad through a hill town in Tuscany.



The French have built fine roads in Algeria. This is the Col de Sfa, the gateway of the Garden of Allah (Biskra).

It is remarkable the wide interest that the road question has for all classes in Europe, and it is this unity of purpose that builds on the net-work legacy left by the Romans. Since that time, and that of the Henris and the Louis, to whom were due much of the elements of beauty that compose the French road system to-day, particularly with respect to tree-planting alongside, and since the later day of the military road-making genius of Napoleon much has been undertaken in the way of refinement which has produced, if not an actual money return, at least a prosperity which would otherwise have been unknown.

European and American Roads Compared.

To be just there are as good roads in the United States to-day as in France. In top-dressing, in comport with the needs of the new locomotion, according to any one of the four or five methods commonly made use of in America, results are superior even to anything yet achieved in Europe. That these "surface roads" are as durable is a question not for discussion here. The rock-metalled, water-bound macadam of Britain, precursor of the Frenchman, Trésaguet, the *pflaster* of Germany or the *pavé* of Belgium at their best are certainly no better to the eye, nor in actual practice when seated on luxurious upholstery and rolling on rubber tires, than much that may be seen in short lengths in some States of the Union.

Little has been achieved in Europe in the redressing of existing roadways with tar, asphalt, cement or any form of bitulithic carpeting which is known so favorably, in one form or another, in America, and which in most cases has been found superior to purely water-bound road-surfacing. In France, particularly, where the thing has been tried, pitiful results have accrued, notably on certain stretches along the Riviera, that battery of Mediterranean coast towns which has become the playground of princes, American millionaires and some others.

Brick is found on some roads of Holland, but it dates from before the automobile era, before even that famous pavement of Terre Haute, Indiana, owning already to some twenty years and still good. Great claims of durability are made for brick, and if these two examples have any weight, the thing would seem to be worth something.

In France there is a famous forty kilometer stretch of *Route National* in the south, near Marseilles, just after leaving Avignon and Arles on the road to the Riviera, straight as an arrow, flat as a billiard table and smooth as marble, with a road of wind-break cypresses on the north, which in the writer's opinion is the very nearly ideal roadway. French

National, Departmental and Communal roads, as a class, are the best in the world. Here and there, it is true, they are showing signs of wear, but the system of upkeep is such that they seldom degenerate into downright bad. From the Channel Ports to Paris there are superb bits of tree-lined roadway, wide well-drained and marvelously engineered, the typical *Routes Nationales*, which have set the pace for all other main highways of the world. South in Poitou and through the Limousin are long silent stretches nearly as good. In the Pyrénées are found superb mountain highways on the French slope and something unspeakable on the Spanish versant, with the result that Alphonse XIII, Europe's automobiling monarch, does most of his road travel in France. In the French Alps are the finest mountain roads in Europe, far and away ahead of those of Switzerland on all counts. Many of them were due to the genius of Napoleon and his military road builders, and if their main purpose in times past was strategic, to-day they are certainly essentially practical. The Col du Mont Cenis, the Col de Mont Genevre, the Lauterest and the giant Galibier (the highest carriage road in Europe save the Stelvio), at an elevation of a mile and two thirds, are the best of their kind, though commonly one thinks of the mountain republic of Switzerland or Italy or Austria when mountain roads are mentioned.

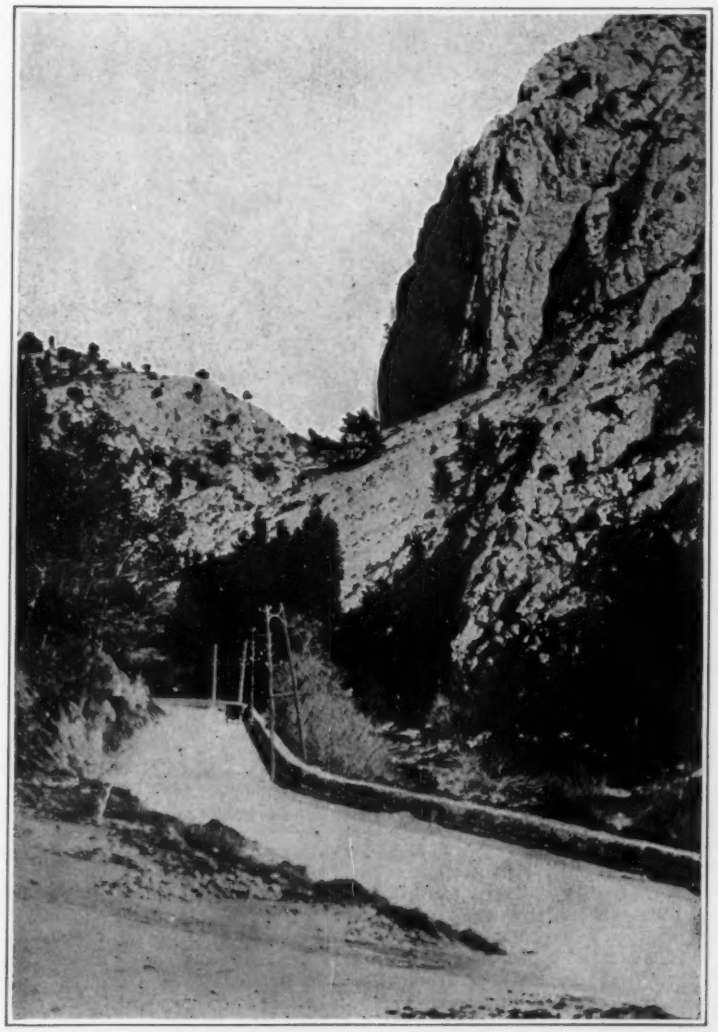
The Mountain Roads of Austria.

The mountain roads of Austria are a close second, particularly when it comes to considering them from the point of view of the automobile. The country is trying hard to get some of the thirty millions which is claimed to be left abroad each year by foreign automobilists in Europe, and it has accordingly put its mountain roads in shape and opened up many new ones within the last decade, until to-day there is a continuous round of fifteen hundred miles at no less an elevation than three thousand feet, with many of the passes, like that of the Stelvio, well above six thousand. Autophobic Switzerland is a big loser with its circumscribed system of cantonal option, resulting that it is but a bridge for the "fast traffic" between Paris and the Italian Lakes instead of being the touring ground that it was in the eyes of a former generation. One enters Italy over the Saint Gothard or the Simplon or Tyrol over Arlberg, but a bare three hundred miles of cross country is all that is left to Switzerland on the main touring route, the valleys and many of the interior roads being given over exclusively to carriage and mail coach, horse-drawn traffic of the days of Mark Twain.

Italy has a nationalized roads system, so has Belgium, Austria and most of the German Confederation. The first three meet the situation but partially, organization and control being decidedly inferior to that in France. Italy's *Strade di Grande Communicazione* are sometimes good, more often bad, and around Naples, Rome and Florence and north toward the Italian Lakes *via* Milan they are too bad forewords, having arrived at this disgraceful stage through, sheer neglect or inattention rather than through any fault in the system of road building in itself. Level crossings, with great well-sweep gates, always shut, abound—there are fifty of them between Vintimiglia and Spezia on the Italian Riviera, the Poor Man's Riviera, so-called to distinguish it from that around Nice and Monte Carlo.

To sum up and bring it home, there is nothing worse in Europe than stretches within half a hundred miles of Manhattan, and nothing quite so good, even in the Bois de Boulogne, as some of the hard-surfaced ribbon roads leading out into the Jersey Hills. Roads in Europe are an economic factor of life and not a fad, however. Recently we read of an army division in the Balkans which made a hundred miles with all its train in a little more than a week, and that truly is going some, even on a first class open road, and military strategic roads are invariably good roads, though they may not be so numerous or have the extent of those mundane thoroughfares which lead merely from town to town. Neither is the farmer abroad taxed in strength, patience, time or purse. In France he is assured a road grade which will enable his beast of burden to pull three tons at a walking gait without aid, an echo of a formula first promulgated by Napoleon—no grades upon which a mountain battery might not gallop at ten kilometers an hour. It is this general, foreordained, inter-locking engineering scheme that puts the continental European roads from the Pyrénées to the Carpathians in the high class which they occupy as strategic military roads unexcelled anywhere. Their "feeders" are of the same general excellence, resulting in a benefit to all sorts and conditions of society, not automobilists alone, though, to be fair, it was the advent of the rubber tire that has caused the wide revival in the question of road travel throughout the civilized world.

National road through the forest of Fontainebleau.



The Gorges d'Ollioulles in the Maritime Alps.

England's Parochial System.

England's parochial system of road control is the chief of the difficulties which road users are experiencing in the tight little isle, and have experienced for long, though it is hoped that the newly founded Road Board (whose secretary, Mr. Rees Jeffreys, was recently in the United States to learn what he might with regard to the fining down of automobile roads, particularly with respect to surfacing) will remedy all this just as soon as it becomes really national in its functions and not merely advisory, leaving the county and parish authorities to do pretty much as they please. Towns and villages in England are often so close together that a highway is frequently one long main street—narrow and twisting at that; and the famous Bath Road of history, for a length not appreciably more than a hundred miles, is under control of a dozen different road builders, each with methods of his own. Results are variable. One length of but a few miles, entering London from the west, is under the *régime* of three different urban councils of greater London. In France, or in any of the continental countries where the national system prevails, this could not be.

Uniform control in France makes a national road of the main street of many a populous town, and as such it is under the direct supervision of the national road building authorities and, as goes without saying, is kept up to national standards, often having a stone kilometer mark set into the façade of the town hall or a Gothic church which may date from the middle ages. It is as if the King's Highway, or *Route Royale*, from which the French *Route Nationale* of to-day has descended, were ambling along in the open plain of La Beauce, the granary of France, where, for miles on end, there are nothing but waving wheat fields on either side, no hedgerows, as in England, no paving blocks as in Belgium and no snake-rail fences as in America—nothing but straight, white, smooth-surfaced roadway along which the automobilist may make what speed he may so long as he doesn't hit anything.

Speed on European Roads.

Speed limits is continental Europe, save for local option in the *agglomerations*, the populated centers, are, in general, tacitly liberal; only in Britain and in Switzerland are they intolerable, if one excepts the ludicrous frequency of the posting of the word *verboten* in Germany, particularly in the Rhine Provinces of the Confederation.

European roads by no means cost as much as in America, wages are lower to begin with and the budget is spread thin. France's ideal centralized system costs but 30,000,000 francs a year, and the first classification of *Routes Nationales* little more than four thousand dollars a kilometer, with certain classes of local roads falling as low as four hundred. It is significant that road markings form as much a part of the European nationalized road systems as roadmaking. Great headstone-like kilometer stones stare out at every five eighths of a mile and blue and white cast iron signboards are at *every* cross-road. In America we have depended largely upon private initiative to give us road directions with, it must be confessed, equivocal results, even admitting in the first instance that the intent was good.

German and Austrian roads as a whole are excellent in their main lines of communication, and the mountain roads of the latter (which also has a National Touring Office which is fathering a pet project to make for the Alps of Tyrol and the Dolomites that which the automobile tourist fails to find in Switzerland) copied after the French formula run them a close second, and are even more spectacular in that they frequently pass through long stretches of wildly savage country, less thickly populated than Dauphiny and Savoy in old France.

Certain German roads are under particularly stringent road regulations and local taxes for upkeep, and these bear on the stranger and the native alike, particularly in certain localities in Wurtemburg and Bavaria, but it is all in the line of progress and is therefore commendable. In the Black Forest and along the Rhine, German roads reach their apogee and are in no way inferior to those of France, which indeed so far as those of Alsace and Lorraine are concerned, are allied to the French tradition of engineering if not of upkeep.

The frontier customs control stations of Continental Europe play a well defined part in the policing of

(Concluded on page 53.)

Will the Automobile Be Driven by Kerosene?

Problem of the Decreasing Supply of Gasoline and the Increasing Number of Internal Combustion Engines

By H. A. Morris

WITH 700,000 automobiles and motor trucks now in use as compared with less than 500,000 in 1911, and with tractors, motor boats, motorcycles and other gasoline burning engines increasing equally rapidly, it is interesting to note that the supply of high-grade gasoline is decreasing, in fact there would have been a shortage in 1911 had it not been for the rapid development of the natural gas condensing process. This is the situation which has brought about the rise in the retail price of gasoline from 13 to 15 cents at retail, and as low as 10 cents at wholesale a year ago, to the present figures of 22 to 25 retail and 16 cents wholesale.

Considering, too, that the present season will boost the number of motor cars in use from the number mentioned to at least 850,000, while plans for 1913 show a production which will put the total beyond the million mark early this spring, it really is a very grave situation, for with a failing supply of fuel there is a natural increase in its use of over 30 per cent. In 1911 the crude oil production increased but 3.5 per cent. Of this less than 10 per cent was classified as gasoline and naphtha, while an additional 45 per cent was kerosene. The former totaled but 20,000,000 barrels, while the kerosene added to these figures would give a total of 117,000,000 barrels.

This situation and these figures would seem to point the way out of the present dilemma, namely, the use of kerosene, either as such with gasoline simply for a starting medium, or mixed with the lighter fuels to make a compound which would be light and volatile enough to make starting, previously the great trouble, easy and simple.

Either one will necessitate new vaporization methods and different vaporizing devices. It will be interesting to note what has been done in this line. It will also be helpful to know what has been done with this and other heavier fuels in stationary engine practice; for good results there point out the way for future motor car success. In an extensive table published by the National Electric Light Association, 29 users reported 1 oil engine each and 8, 2 each, making a total of 45 engines in 37 plants. The oil varied from 19 to 40 deg. Baumé specific gravity, with the average at 28.5. The British thermal units in the fuel varied from 18,000 to 19,000, 20 showing 19,000 or more. Oil cost varied from 1.77 cents a gallon to 4 cents, 31 averaging 2.60 cents. Fuel cost a kilowatt-hour for 17 varied from 0.189 to 0.501 cent and averaged 0.304 cent. Cost of horse-power-hour for 6 others varied from 0.184 to 0.778 cent and averaged 0.333. The total costs, including lubrication, waste and other supplies, also attendance, varied from 0.352 cent to 1.310 cent a kilowatt-hour for 16 and averaged 0.796. The same on a horse-power-hour basis varied for 3 from 0.644 cent to 1.411 cents and averaged 0.916 cent. The power a unit varied from 75 up to 500.

This shows that heavy oils of one tenth the present cost of gasoline may be used with economy, no trouble, and marked success in stationary engines. It remains only for motor car and gasoline engine builders to produce devices which will allow of using this same abundant fuel for those motors. In California, stationary engine practice has been adapted to many automobiles by the simple addition of a pump, with piping and a tank, so as to spray water into the vaporizing chamber simultaneously with the admission of distillate, which is plentiful and costs about 2 cents a gallon. When this is done, the water furnishing additional oxygen for vaporization, bringing about more complete vaporization, preventing carbon deposits, softening down the explosions by producing a slower burning effect, and preventing pre-ignition, the usual cooling system is modified by the use of gaskets in the pipe connections, so that the cylinders and other parts will be kept slightly hotter (30 degrees is given as the most satisfactory figure).

In some fuel tests conducted about a year ago at the Automobile Club of America's laboratory in New York city on a standard four-cylinder automobile engine, the power development on gasoline exceeded that of kerosene at 625 revolutions per minute by only 1 horse-power equal to 6.5 per cent, at 925 revolutions per minute by 1¾ horse-power equal to 8.3 per cent, and at 1,210 revolutions per minute by 5.3 horse-power equal to 26.3 per cent. These tests were made without change of carburetor or any other change in the engine and would seem to show the necessity for a special vaporizing device for heavy fuels at the higher speeds where the difference shows the greatest.

In the annual agricultural motor trials at the Winnipeg Fair, a class, increased to two classes in 1912 on account of heightened interest, is set aside for kerosene burning engines. From the 1912 results, taking engines of equal size and, where possible, of the same make, kerosene showed to advantage in nearly every direction. Thus the fuel cost of plowing an acre was lowered from 49.725 cents for 12 gasoline engines, with 64.9 as the highest and 37.3 as the lowest figure, to 49.927 cents for 7 kerosene burners. The highest of the latter was 59.9 and the lowest 33.7. If this single very high figure had been eliminated in the average, the other 6 would have given 45.93 as a result. The number of horse-power-hours from a dollar's worth of fuel (the respective costs were 14½ cents for kerosene, 19½ cents for gasoline as compared with 12 and 20 cents in 1912) was 73.42 using kerosene and 55.90 on gasoline. This shows to the advantage of kerosene by 31.3 per cent. In 1912, due to the difference in price, this same advantage in four selected classes was 64.2, 76.5, 42.5 and 59.4 per cent. In 1911 the figures were 27.5, 25.2, 10.9 and 74.3 per cent.

This shows that by using the fuels of lower specific gravity, commonly called heavier fuels because they weigh more, superior economy may be obtained varying from 11 to 75 per cent. Taking an average at 50, this means that with a proper vaporizing device for the heavy fuel, the owner of an automobile who got 70 miles for a dollar when burning gasoline, could change to kerosene and get 105 miles for a dollar. These figures reversed show that the cost a mile of this automobile for fuel alone would be nine tenths of a cent (0.9 cent) for kerosene as compared with 1.4 cents for gasoline.

In the main, the vaporization of kerosene is brought about by two things; a fine division of the liquid as it enters and the addition of a large amount of heat. It is preferable, experimenters tell us, to convert the chemical state, making the liquid into a fixed or permanent gas, but not all of the available vaporizers do this. The addition of the heat is usually by means of exhaust gases or jacket water or both; in many cases, the vaporizing device is actually placed in the muffler, where it gets all the heat out of the exhaust gases before they are rejected into the air.

Some idea of the amount of heat necessary may be gained from the simple statement that good results cannot be obtained below 250 deg. Cent. (482 deg. Fahr.) and the best are produced at 300 deg. Cent. (572 deg. Fahr.). Two other considerations enter into the construction of the kerosene vaporizing device, according to the results of the greatest experimenters, namely, accurate control of the fuel, and storage space or a device which produces flexibility. As to the former, the amount of liquid is so small as compared with the large volume of air that the latter or the gas produced must be controlled to give close and dependable results. As to the latter, starting and stopping in traffic call for a quick reduction or a storage place for gas produced in one case, and a quick acceleration of the rate of production or a storage space already filled to give the same result in the other.

Generally speaking, the devices abroad which have been successful on alcohol, benzol and other heavy fuels do very well on kerosene. Among these may be mentioned the Butler (English), Southey (English), Martha (French), Banki (Austrian), Brouhot (French), Capitaine (Italian), Longuemare (French), Merienfelde (German), Richard (French), Japy (French), Sleipner, Deutz & Koerting (German) and others, one of which is the better known Diesel engine. It may be interesting to compare the economy of the last named with a new device for using kerosene on an automobile motor brought out in England by an Italian engineer, G. Christianapolo, and called after him the G. C. This is inclosed in a muffler, so that all of the exhaust heat is used.

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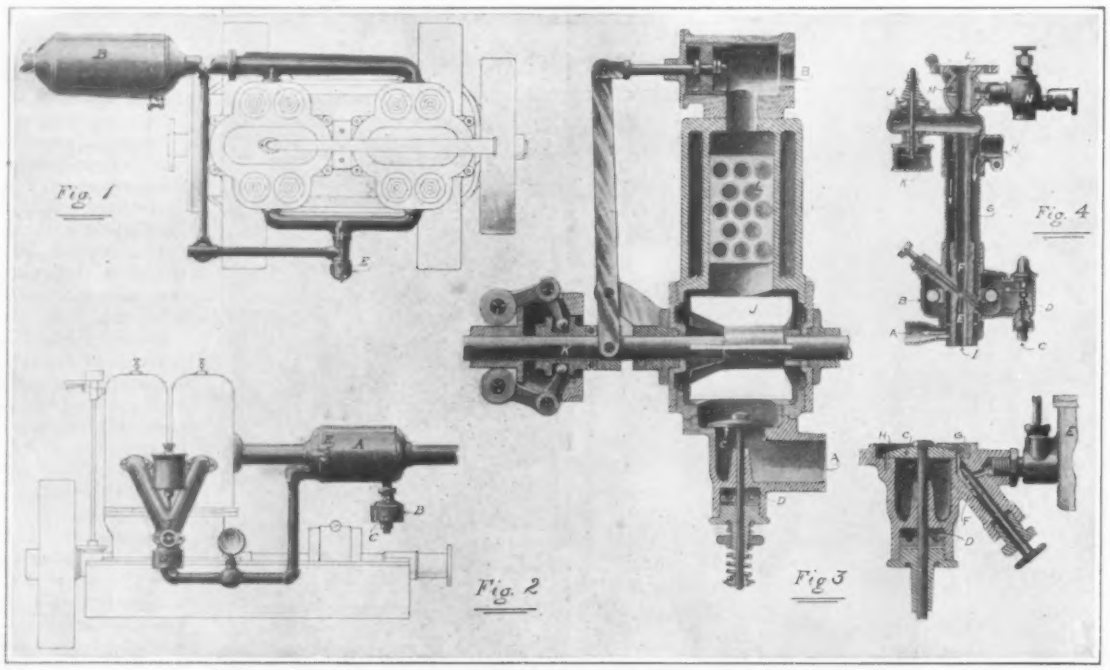

Kerosene and heavy oil fuel possibilities.

FIG. 1.—Plan view of a four-cylinder automobile engine with universal oil converter attached. *B*, converter into which the exhaust gases have a straight flow. *E*, electrical admission device which governs amount of heat used in converting fuel to a gas and controls the admission of gas to cylinders.

FIG. 2.—Side view of universal kerosene converter attached to a two-cylinder marine engine, where it takes the place of both carburetor and muffler. *A*, the converter with float at *B* and spray nozzle lever at *C*. The amount of gas and its passage is controlled by means of the lever *E*. This outfit is arranged for gasoline starting through the usual carburetor float chamber at *G*.

FIG. 3.—Section through Davis (English) kerosene vaporizer acting in conjunction with a governor to give automatic control of the automobile engine. *A*, air inlet port; *B*, gas outflow port to the cylinders; *C*, control poppet valve; *D*, dashpot covering valve action; *E*, float chamber; *F*, kerosene jet; *G*, nozzle; *H*, pin to prevent the valve from turning; *J*, fan to break up mixture of kerosene gas and air; *L*, exhaust heated vaporizer for the now well diffused mixture; *K*, shaft driven from the motor.

FIG. 4.—Sectional drawing of the Holley kerosene carbureter showing constructional features. The fuel enters at *C*, passing needle valve *D*, and enters float chamber *B*, which is heated by exhaust gases entering at *H* and leaving at *A*. The primary air supply enters at the base at *I*, draws the fuel out of the spray nozzle *E* into vaporizing chamber *F*. *G* shows heated gas passage. Auxiliary air enters through valve *J*, which is prevented from fluttering by dashpot *K*. The completely mixed gas passes through valve *M* to the cylinder by the opening *L*. Simple mixing valve *N* is provided for gasoline used at starting.

Clever Devices that Help Motorists

European Inventions That Meet Real Needs

IT must be stated emphatically here that the technical refinements and auxiliaries to be described were not caused by any distrust in the ability of the cars to surmount the mountain difficulties, but by a desire to save time, trouble and possible penalties during the tour.

As usual in races and reliability trials, the lubricating apparatus received the most careful attention. Almost every entrant had a little trick of his own by means of which he could increase his available oil supply, or accelerate the flow of lubricant to the parts where it was needed. Brakes and gasoline tanks also received due attention, priming apparatus and a host of unique improvements were invented and attached by the drivers themselves.

An English car, for instance, had a special rear spring suspension, shown in Fig. 1. The lowest of the horizontal leaves is fully five feet long and rotates in the center on a fixed pivot, as well as being fastened to a hinged support on the chassis frame. This construction is productive of extremely easy riding owing to the great length of the spring.

In an Austrian car, shown in Fig. 2, the manner of attaching the two spare wheels is unusual. The chassis frame carries a right-angled iron pipe, threaded at the free end, upon which the wheels are slipped and retained by the cup *B* and the nut *S*. The nut is fitted with a short handle, facilitating quick removal of the wheels. The brake adjusting device, shown in the same illustration, is the acme of simplicity; it consists of nothing but a double-threaded spindle inserted in the brake rod. To keep continuous watch over the motor a small electric lamp *L* is affixed to the dashboard directly behind the engine, the whole being visible through the glass window *S* in the dashboard.

An Italian car sported a queer-looking radiator cap, shaped like a rounded cone (Fig. 3), for the double purpose of condensing the steam rising from the radiator and preventing hot water from being carried away with the steam.

Three emergency tanks were carried by a French car, illustrated in Fig. 4. *B* represents the gasoline tank, *W* the extra water reservoir and *O* the emergency oil tank. The gasoline tank is of great capacity, and is filled through the top of the back of front seat.

The most novel, interesting and important device, however, was seen on an Austrian car, shown in Figs. 6 and 7. While the arrangement of the emergency gasoline tank under the front seat is common practice, the installation of an air filter on the dashboard is a step that will be watched by every automobile manufacturer. Dirt and dust, carried into the carbureter through the air ports, are responsible for a large part of all the carbureter troubles and any scheme tending to eliminate this difficulty must needs command attention. The filter is pictured in Fig. 6, where *W* stands for the dashboard, *R* for the pipe leading to the carbureter, *S* for the permanent sieve, and *T* for the easily removable linen filter, held in place by a brass ring. The chief value of the device lies in the accessibility of the filter, and its removable linen sieve, which when clogged up can be replaced by a new clean one in a moment, without stopping the car or the motor.

One of the big German cars, outlined in Fig. 5, evidently took no chances in being caught without a sufficient supply of gasoline. The carbureter of this machine was of such a construction as to render the use of gasoline of different specific gravities unsatisfactory, and in order to obviate this difficulty a plentiful supply of the sort of gasoline best suited to the carbureter was carried along—sufficient for the entire trip. The net weight of this extra supply was more than 600 pounds. *B* and *C* are pressure tanks, while *A* supplies the carbureter by gravity feed.

Fig. 8 gives the arrangement of one of the many clever oil "accelerators" used on the tour. The pump *P* forces air into *H*, whence it escapes through either *A* or *B*, according to the position of the two-way cocks. *A* leads to the oil tank, *B* to the water reservoir. The oil is not forced directly from the tank into the motor, but rises first in the pipe *R*, falling through a filter and the pipe *O* into the motor. In Fig. 8*a* is shown how the compressed air from the pump *P*, going through

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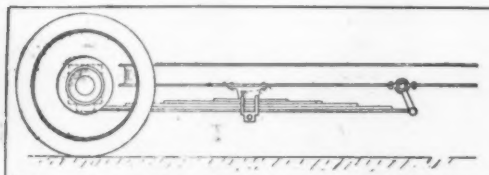


FIG. 1.—A special rear spring suspension, productive of extremely easy riding owing to the great length of spring.

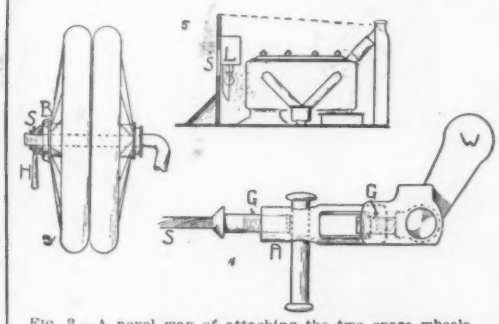


FIG. 2.—A novel way of attaching the two spare wheels.

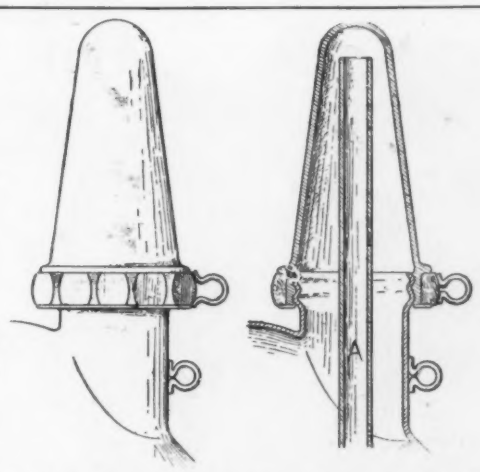


FIG. 3.—This queer looking radiator cap serves the double purpose of condensing the steam rising from the radiator and preventing hot water from being carried away with the steam.

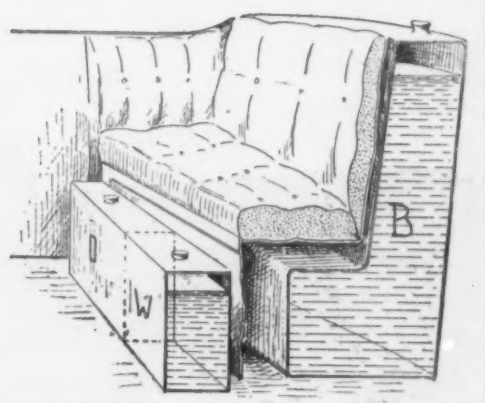


FIG. 4.—Three emergency tanks, of which *B* represents the gasoline tank, *W* the extra water reservoir, and *O* the emergency oil tank. The gasoline tank, of great capacity, is filled through the top of the back of the front seat.

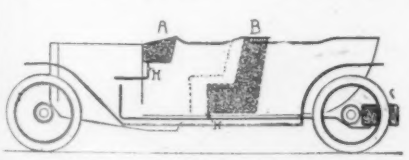
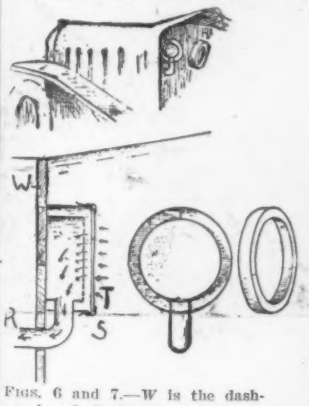
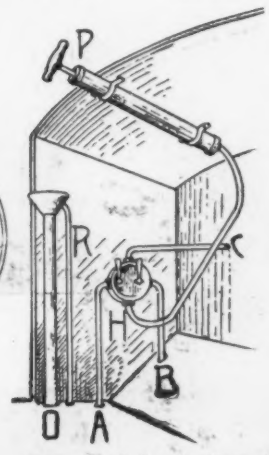


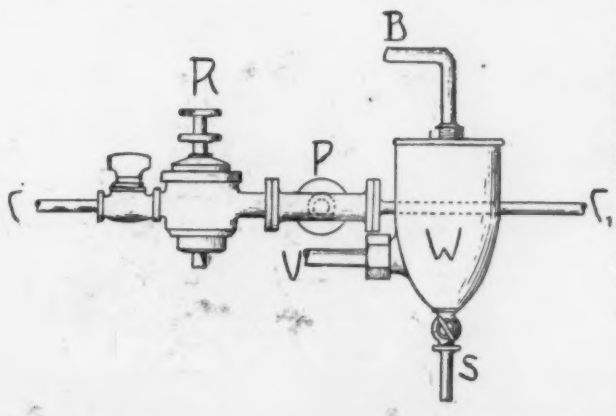
FIG. 5.—A big German car that could not operate with gasoline of different specific gravities. Sufficient fuel (600 pounds) for the entire trip was carried in pressure tanks *B* and *C*, while the tank *A* supplied the carbureter by gravity feed.

"Unpunishable infractions of the rules and regulations" one is inclined to call the little technical tricks and the refinements with which the participants in one of Europe's recent reliability runs for automobiles equipped their cars. Although the aim of the tour was not to test and develop freak accessories for use on motor cars, the tourists felt the need of a little assistance in crossing the Alps during a contest. Consequently, they racked their brains for ways and means to increase the power, fuel capacity and lubricating facilities without transgressing the letter of the contest rules. The following article, condensed from the Allgemeine Automobil-Zeitung, succinctly describes the clever devices invented for the occasion.—EDITOR.



FIGS. 6 and 7.—*W* is the dashboard, *R* the pipe leading to the carbureter, *S* the permanent metal sieve, and *T* the removable linen filter, held by a brass ring. This air filter on the dashboard prevents dirt and dust from being carried into the carbureter through the air ports.





FIGS. 8 and 8*a*.—A clever oil accelerator. The pump *P* forces air into *H*, whence it escapes through either *A* or *B*, according to the position of the two-way cocks. *A* leads to the oil tank, *B* to the water reservoir. The oil is not forced directly from the tank into the motor, but rises first in the pipe *R*, falling through a filter and the pipe *O* into the motor. Fig. 8*a* shows how the compressed air from the pump *P* passes through the reducing valve *R* to the fuel tank, forcing gasoline into the separator *W*, where it is freed from water, and then through *V* to the carbureter.

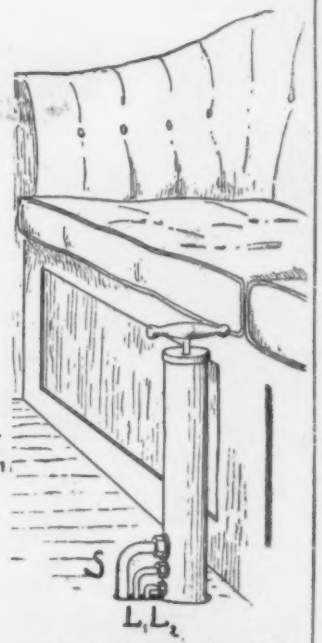


FIG. 9.—Another oil accelerator. The pump is here located between the two front seats with three pipes: *S* for suction from the oil tank, L_1 for connection with the motor, L_2 for the connection with the brakes.

Overland

$98

COMPLETELY E

Self-Starter
30 Horse-Power
5-Passenger Touring Car
110-Inch Wheel Base

Timken Bearings
Center Control
Remy Magneto
Warner Speedometer

85

LY EQUIPPED

ken Bearings
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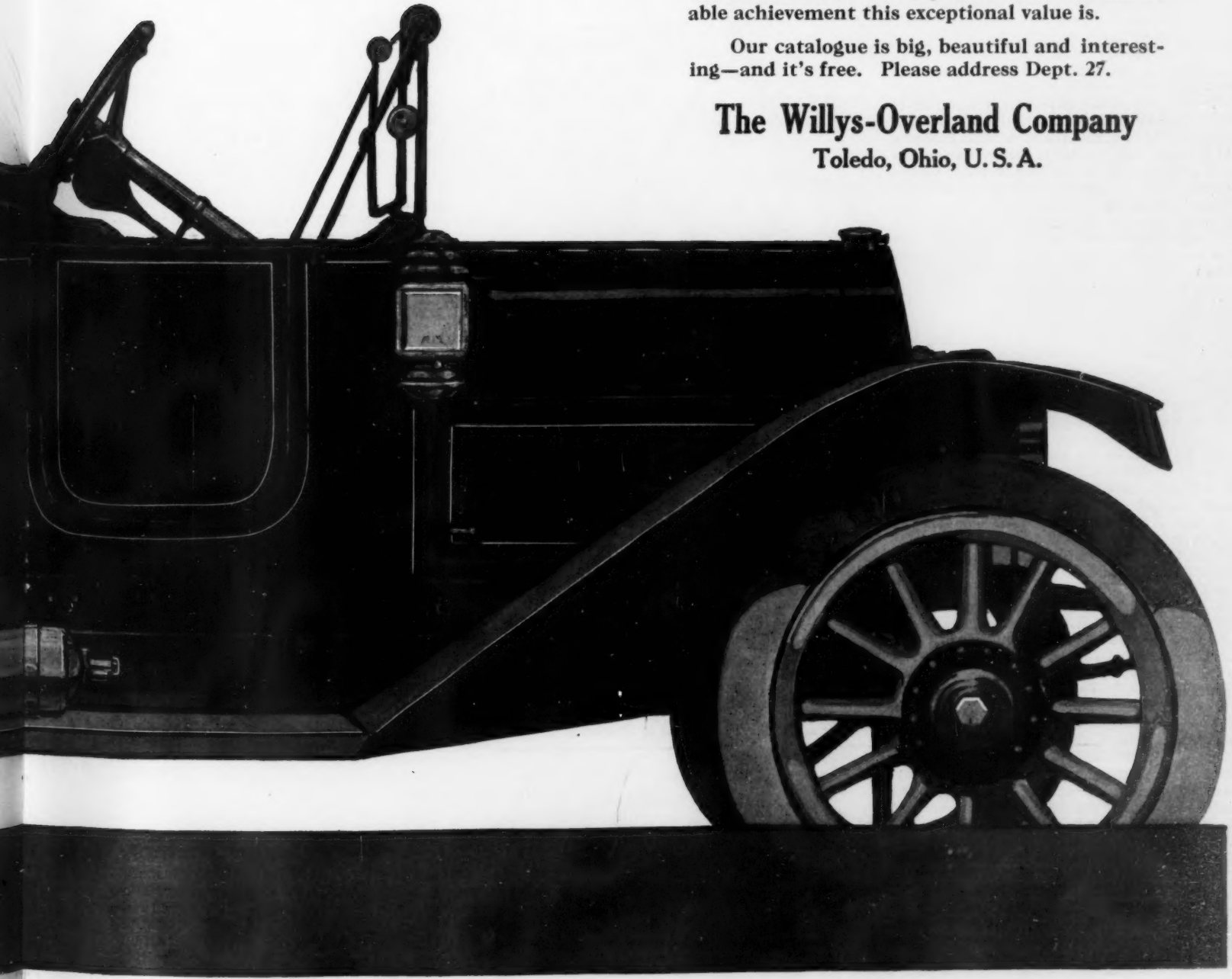
Mohair Top and Boot
Clear Vision Wind Shield
Prestolite Tank



Overland

WE are, and have been, over 3000 cars behind immediate shipping orders ever since last August—when this model was first introduced. Dealers contracted for 39,000 cars before we made a public announcement; one dealer alone took 4000; in thirty days Europe had arranged for $1,000,000 worth.

We have planned and prepared for a 1913 production of 40,000 cars. Eight thousand skilled mechanics in a factory covering over eighty acres are working night and day to fill present and persistent orders.

There are over 3000 Overland dealers in all parts of the world. Look up the one in your town. See this car, and you will more readily understand what a really brilliant and remarkable achievement this exceptional value is.

Our catalogue is big, beautiful and interesting—and it's free. Please address Dept. 27.

The Willys-Overland Company
Toledo, Ohio, U. S. A.

the reducing valve *R* to the fuel tank, forces gasoline into the separator *W*, where it is freed from water, and then through *V* to the carbureter.

Somewhat similar is the construction shown in Fig. 9. The pump is here located between the two front seats, with three pipes: *S* for suction from the oil tank, L_1 leads to the motor, and L_2 to the brakes.

A priming device which was on nearly all the cars is shown in Fig. 10. It consists of nothing more than a wire protruding through the radiator and attached at the other end to an angular lever. *K* is the carbureter, *S* the float stem, *H* the lever, and *D* the wire.

More ingenious is the device shown in Fig. 11, which one of the drivers employed to obtain quick adjustment of the fan belt drive, without being compelled to stop the car—the run being a non-stop contest over mountain roads. Z_1 and Z_2 are actuated by the rod *W*; *H* is firmly fastened to the sector Z_2 and carries the shaft of the rotating fan; *R* is the belt. The rod *W* is controlled by a lever on the dashboard.

Still another clever device was used by a German car, and is illustrated in Fig. 12. It consists of a windshield having a narrow slit in the glass. The arrangement guarantees a clear view ahead even if heavy rain and mud cover the glass. Inclining the shield more or less allows each driver to adjust the height of the slit to his own requirements, by means of the usual device, shown in Fig. 13.

The last two illustrations show a time-saving device, which is not unknown in this country, in connection with the easier handling of touring maps. By means of rollers and a small frame with a glass front it is possible to keep the map in full view and yet safe from being blown out of one's hand, while the entire plate and holder can be folded under the cowl dash out of the way when not in use. Special ribbon-like maps are used in this device.

The Carob Bean Tree

THE carob bean is the commercial name for the ripe pods or fruit of a tree called botanically *Ceratonia siliqua* Linn. of the pea family of plants. The fruit of this tree is variously known as carob, carob bean, algaroba, algarroba, karoub, caroubier, locust, sweet bread, sugar pod, and St. John's bread. It is supposed that these seed pods are the locust and wild honey which St. John found in the wilderness, hence the derivation of the common name of St. John's bread. The "husks" on which the prodigal son of scripture subsisted were the dry pods of the carob bean. The tree is a native of the European, African, and Asiatic countries bordering on the Mediterranean Sea, but it has now become naturalized in practically all localities in which oranges are grown. It is a beautiful evergreen tree attaining a height of from 40 to 50 feet, and is now being cultivated very generally and plentifully in southern Europe, both for shade and for the edible pods. The yield of these pods per tree is often great. Some trees frequently produce as much as 800 or 900 pounds.

The carob tree does not stand frost, but it grows well in dry, rock soil, and should prove a valuable acquisition for planting in parts of the southern States. The United States Department of Agriculture, has, from time to time, propagated and distributed many hundreds of young carob trees, chiefly in Texas, Florida, and in other southern States. In order to encourage its cultivation in Florida, the department propagated it in the experiment garden at Miami, Florida. In response to numerous requests received from farmers and others, the station distributed seeds and cuttings, and a number of healthy young plants are now growing in the southern part of the State. This valuable tree has been tested also in southern California, and its culture, doubtless, will become quite general, because there is no other tree that is likely to become more popular for shade and ornament in dry, rocky situations than the carob tree. It can not only be trained into a very ornamental shade tree, but may be planted as a wind break to more tender vegetation. Its introduction into southern New Mexico and Arizona has been recommended as an important addition to the food supply for stock in those States. Occasional trees are now growing around San Antonio, Texas.

The carob trees is at present cultivated in all warm countries which suffer from periodical droughts, its long roots penetrating to a great depth in search for water. It will grow in almost any kind of soil, provided it is thoroughly drained. In southern Florida it grows very rapidly on the dry shallow soil underlaid with the porous oolitic limestone. It is said to prefer limestone soil, but it will flourish on almost pure sand or on rich alluvial soil. The carob tree is very common in some parts of the Canary Islands, and in 1883 was introduced to Jamaica. Its introduction into the semi-arid parts of Chile and Argentina has been attended with considerable success. It is grown also very extensively in South Africa, Australia, and Sandwich Islands. In all these countries the carob tree can be grown in places where no other trees will grow, notably on the dry, arid regions, and it seems certain

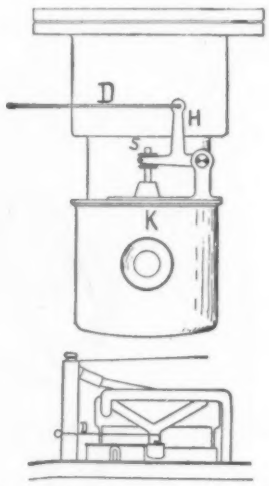


FIG. 10.—A priming device, consisting of a wire protruding through the radiator and attached at the other end to an angular lever. *K* is the carbureter, *S* the float stem, *H* the lever, and *D* the wire.

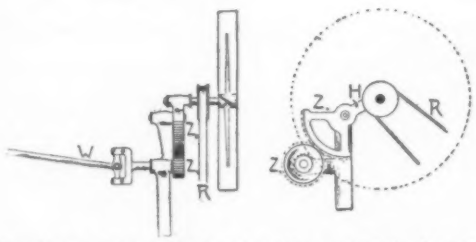


FIG. 11.—A device to obtain quick adjustment of the fan belt drive without being compelled to stop the car. Z_1 and Z_2 are actuated by the rod *W*; *H* is firmly fastened to the sector Z_2 and carries the shaft of the rotating fan; *R* is a belt. The rod *W* is controlled by a lever on the dashboard.

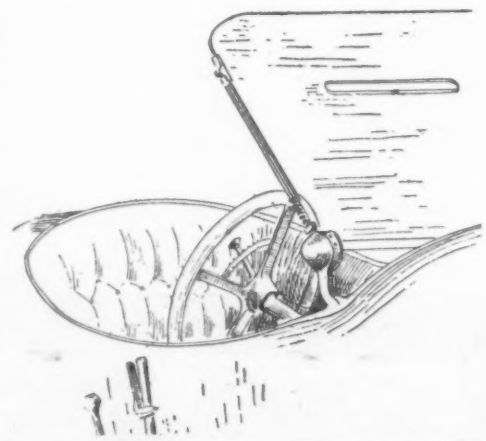


FIG. 12.—A wind shield having a narrow slit in the glass thus guaranteeing a clear view ahead, even if heavy rain and mud should obscure the glass.

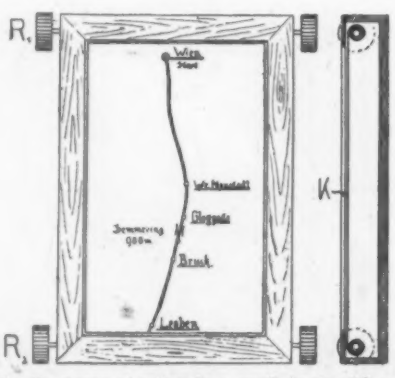


FIG. 13.—By means of rollers in a small frame with a glass front, it is possible to keep the map in full view and yet safe from being blown out of one's hand.

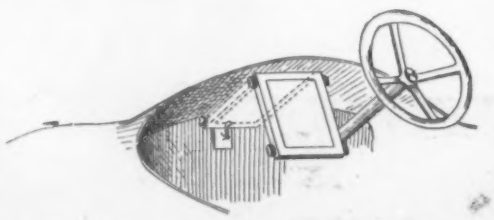


FIG. 13a.—The map holder shown in Fig. 13 in place. The entire plate and holder can be folded under the cowl—out of the way when not in use.

that in the endless varieties of soil and climate found in southern New Mexico and Arizona there must be many districts where it would prove very successful. The introduction of this tree would be simply invaluable to the people along the Rio Grande, especially at times when forage for their stock is scarce. Not only does the carob tree furnish food for horses, but also shade for cattle and sheep.

In practically all tropical and subtropical countries the tree is cultivated extensively for the pods which form an important article of trade. The fruit is a dark-brown leathery pod of from 4 to 10 inches long, and often an inch or more wide, but not over a quarter of an inch in thickness. It contains a gummy, pulpy substance of an agreeable sweet taste, which renders the pods an important article of food for the poorer classes wherever the tree grows. Although the edible portion of these pods contains about 60 per cent of sugar, it possesses very little real nutritive value, the saccharine matter belonging to the class of foods called carbonaceous; the seeds alone possess nitrogenous matter, and these are flat, hard, shining-brown, about the size of a lentil and cannot always be readily masticated. In recent years these pods have been imported into England and the United States, and have become a common article of sale in the small shops of the poorer neighborhoods of London and New York, where the children purchase them for the sake of the sweet pulp which surrounds the seeds. Large quantities of these pods have been imported into England as food for horses, and it forms one of the chief ingredients in the patent cattle foods. The value of the carob beans exported from Cyprus, an island in the Mediterranean Sea, has in some years reached over $30,000. Not only are the pods valuable, but every part of the tree is useful. The wood is hard, heavy and is very durable in contact with earth and water.

The carob tree is propagated usually by seed, which is the most natural and also the easiest method. Propagation by layers, cuttings or grafting may be advisable if one wishes to be sure to grow a special variety, of which there are a number; but to make a start in carob culture it will be best to plant the seed, and other methods can be attempted later. The best time to plant the seed is in August. The covering of the seed is very hard, and in order to hasten germination it is recommended to place them in hot water (not boiling) until they are softened, which may take from 2 to 10 days. When this is done the seeds should be planted at once in their permanent places. In this event, the young plants must be watered regularly and kept free from weeds until they are old enough to take care of themselves. When cuttings are used these should be prepared about 6 inches long from matured one-year-old wood in March or April. The advantage of propagating the carob tree by cuttings is that fruit-bearing trees can be selected and in this way regulate the number of male and female trees. To insure the fertilization of the female flowers there should be from one to two males to every 50 female trees. Those who cultivate the carob trees in the Orient usually keep bees, because it is by means of these insects that a great many flowers are fertilized.

The distance the trees should be planted apart depends upon the local conditions, and the object of the plantation. If it is planted for a wind break, 8 feet apart will probably not be too close. In cases where it is desired to grow large trees for the fruit they produce, 30 feet each way is recommended.

Motor Trucks Articles in Next Week's Scientific American

THE subject of the automobile is now so big that it is impossible even in an enlarged issue of the SCIENTIFIC AMERICAN to discuss all its phases. In this number we have confined ourselves entirely to pleasure cars. Since the motor truck cannot be ignored, we will devote to it considerable space in next week's SCIENTIFIC AMERICAN. In that issue the reader will find a general article in which the capabilities of motor trucks are graphically compared with the capabilities of horse-drawn vehicles in one of those comparative drawings which were invented by the SCIENTIFIC AMERICAN many years ago, and which tell their story more tellingly than words. There will also be a table of motor trucks similar to that of gasoline and electric pleasure cars to be found this issue on pages 44 and 46; but in that table motor trucks will be classified, not according to price, but according to their capacity.

Preventing Oil Cloth from Cracking

A GOOD way to prevent oil cloth from cracking when used as covers for tables is as follows. A few thicknesses of paper are placed on the table and moistened thoroughly with machine oil. This will cause the oil cloth to last much longer, remain soft, and prevent cracking of the glazed surface. It should be stretched tightly over the oiled paper.

No-Rim-Cut Tires 10% Oversize

By Far Outsell All Others

This Winter Tread

Will Indicate Why the Goodyear Won

Last year we sold 918,687 automobile tires.

Yet we failed to keep up with the flood-like demand by some 400,000 tires.

Seven years ago only one tire in ninety was a Goodyear tire.

Three years ago the demand was still one-twelfth as large as now.

Last year's sales by far exceeded our previous 12 years put together.

What has awakened men to Goodyear tires in this overwhelming way?

This winter tread will tell you. It shows how far we go, in every way, to multiply efficiency. To cut down tire expense.

This is only one item, but it reveals the entire Goodyear code.

Compare this tread with others, and you'll see why Goodyears won.

Note the Double Thickness

In this Non-Skid tire we add an extra tread almost as thick as the regular. Thus we give you a double-thick tread.

This extra tread is of very tough rubber, immensely enduring, almost impervious to wear.

Because of its thickness, the blocks are deep cut. Their non-skid efficiency lasts for thousands of miles.

A Bulldog Grip

These sharp-cut blocks present to the road surface countless edges and angles.

They grasp the road in every direction with a fairly irresistible grip.

But the greatest advantage lies in the fact that these blocks widen out, so they meet at the base.

They are not separate projections, which center the strain on a small part of the fabric. They distribute the strain exactly the same as with smooth-tread tires. That's the main reason why the Goodyear Non-Skid gives such exceptional mileage.

Compare this tread with others. Compare its thickness, the depth of its projections. Compare the apparent efficiency, due to these sharp-cut blocks.

Compare the way in which strains are distributed so the fabric can't be broken. One glance will show you that this Non-Skid surpasses anything else of its kind. About 250,000 of these treads have already been tested out.

Other Troubles Ended

Thus we have ended skidding troubles in the most effective way.

Years ago we ended rim-cutting, just as completely, just as efficiently.

Our patent tire—the No-Rim-Cut tire—has made rim cutting simply impossible.

And that alone cut tire expense 25 per cent.

Our 10 per cent oversize, under average conditions, adds 25 per cent to the tire mileage.

Our fourteen years of ceaseless tests and comparisons have brought our tire quality up to the maximum.

These things together, in the test of time, have placed the Goodyears on at least a quarter million cars.

One Must Respect This Verdict

Remember, please, that tire expense forms your major cost of upkeep.

A tire which cuts that cost in two is something quite important.

Men know when they get it in these days of odometers. They know which tire serves best. And the final verdict of these men who know favors Goodyear tires.

Men have tried and compared now pretty close to 2,000,000 Goodyear tires. As a result the sale of these tires has doubled every year. And last year's increase was 125 per cent.

Now these tires by far outsell all others. And this year's output, if this increase continues, will completely equip 500,000 cars.

One may easily question any maker's claims. But when hundreds of thousands of users unite, one must respect their verdict.

The verdict of experience favors Goodyear tires in an overwhelming way. And every month makes the verdict more convincing.

Is it not fair to suppose that your experience will bring a like result?

If you think so, get that experience. Make some comparisons. Settle this question by next time insisting on Goodyear No-Rim-Cut tires.

Write for the Goodyear Tire Book—14th-year edition. It tells all that we know, after fourteen years, about cutting down tire expense.

GOODYEAR

AKRON, OHIO

No-Rim-Cut Tires

With or Without Non-Skid Treads

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

Branches and Agencies in 103 Principal Cities
More Service Stations Than Any Other Tire

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits
Main Canadian Office, Toronto, Ont.—Canadian Factory, Bowmanville, Ont.

What Gasoline Pleasure Car Can I Buy?

A Composite Price List of American Pleasure Cars

Compiled by Theodore M. R. von Kéler

As long as the motor car remained a luxury for the few, the question of price was a secondary consideration. Quality, speed and power were the chief points which the intending purchaser considered. A few hundred dollars more or less, both in first cost and in up-keep expenses, made little difference to the man desirous of possessing an automobile. Conditions have changed. It is the man of moderate means—the professional man, small merchant and fairly well-to-do farmer—who is the best customer of the automobile dealer. To him the question of price is usually a very essential one. With a view to assist him in a choice of cars suited to his pocketbook, the price list below has been compiled.

Because of the complexity of the undertaking, the list is not complete. It does not include the manufacturer whose whole output during the past year did not reach 100 cars; it does not include every model turned out by the manufacturers listed; it does not include new models announced after January 1st, 1913. It does, however, include the leading types of cars turned out by 131 manufacturers, with prices revised up to and including January 1st, 1913. Wherever further information as to other types is desired, a request to the manufacturers will bring complete details, catalogues and specifications.

Name of Car.	Name and Address of Manufacturer.	Under $600	$600 to $1,000	$1,001 to $1,500	$1,501 to $2,000	$2,001 to $2,500	$2,501 to $3,000	$3,001 to $4,000	$4,001 to $5,000	Over $5,000
Abbott-Detroit	Abbott M. C. Co., Detroit, Mich.				30 *rd*, $1,700	44 *rd*, $2,150		44 *lim*, $3,050		
Alco	American Locomotive Co., New York									60-*t*, $6,000
American	American Motors Co., Indianapolis			25 *rd*, $1,475	25 coupé, $2,000	32 *rd-t*, $2,350		32 *lim*, $3,500	50 *t*, $4,500	50 *lim*, 6,000
Ames	Ames M. C. Co., Owensboro, Ky.				45 *t*, $1,635	60 *t*, $2,250				
Amplex	Amplex M. C. Co., Mishawaka, Ind.								68 *t*, $4,500	
Apperson	Apperson Bros. Auto. Co., Kokomo, Ind				32 *t*, $1,600				48 *t*, $4,200	
ArBenz	The ArBenz Car Co., Chillicothe, Ohio.				48 *t*, $1,750					
Atlas-Knight	Atlas Motor Car Co., Springfield, Mass.							32 *r-t*, $3,500		
Auburn	Auburn Auto. Co., Auburn, Ind.			26 *t*, $1,100	32 *t*, $1,750		41 *t*, $3,000			
Austin	Austin Auto. Co , Grand Rapids, Mich.							45 *t*, $3,600	50 *t*, $4,400	77 *t*, $6,000
Babcock	H. H. Babcock Co., Watertown, N. Y.						32 *t*, $3,000			
Bergdoll	Louis J. Bergdoll M. Co., Philadelphia, Pa.			26 *rd*, $1,500	40 *t*, $2,000	40 *t*, 5 p, $2,400				
Berkshire	Berkshire Motors Co., Pittsfield, Mass.						27 *t*, $3,000	40 *t*, $4,000		
Buick	Buick Motor Co., Flint, Mich.		28 *rd-t*, $950	32 *rd-t*, $1,125	40 *t*, $1,650					
Cadillac	Cadillac M. C. Co., Detroit, Mich.				50 *t-rd*, $1,975	50 coupé, $2,500		50 *lim*, $3,250		
Case	J.I.Case Motor Works, Racine, Wis.			30 2p, *rd*, $1,500		40 *t*, 5 p, $2,200		40 *lim*, $3,200		
Cameron	Cameron Car Co., Beverly, Mass.		24 *t*, $975	37 *t*, $1,400						
Carhartt	Carhartt Auto. Corp., Detroit, Mich.			27 *r-t*, $1,350						
Cartercar	Cartercar Co., Pontiac, Mich.				5A *t*, 5p, $1,700					
Chadwick	Chadwick Eng. Wks., Pottstown, Pa.									60 *rd-t*, $5,500
Chalmers	Chalmers Motor Co., Detroit, Mich.				36 *rd-t*, $1,950	54 *rd-t*, $2,400	54 *t*, 7p, $2,600			
Cino	Haberer & Co., Cincinnati, O.						38 *t*, $2,750			
Cole	Cole Motor Car Co., Indianapolis, Ind.				40 *rd-t*, $1,685	60 *rd-t*, $2,485				
Columbia-Knight	Columbia M. C. Co., Hartford, Conn.								38 *t*, $4,500	
Crow	Crow M. C. Co., Elkhart, Ind.			33 *rd*, $1,200	32 *t*, $1,750		60 *t*, $3,000			
Croxton	Croxton M. C. Co., Washington, Pa.					30 *r-t*, $2,500	48 *t*, $3,000			
Cunningham	Jas.Cunningham,Son&Co.,Rochester,N.Y.							36 *t*, $3,500		
Cutting	Cutting M. C. Co., Jackson, Mich.			40 *rd-t*, $1,475						
Day Utility	Day Auto. Co., Detroit, Mich.			33 *t*, $1,500						
Davis	G. W. Davis Co., Richmond, Ind.				3-40 *r-rd-t*,$2000	50 *t*, $2,100				
Detroiter	Briggs-Detroiter Co., Detroit, Mich.		25 *rd-t*, $850							
Duryea	Duryea Motor Car Co., Saginaw, Mich.	Motor buggy prices on application								
Empire	Empire Automobile Co., Indianapolis, Ind.		20 *rd*, $750							
Enger	The Enger M. C. Co., Cincinnati, Ohio			40 *rd-t*, $1,475	40 *rd-t*, $1,750					
Fiat	F. I. A. T., Poughkeepsie, N. Y.							35 *t*, $4,000	50 "Six," $5,000.	
Firestone-Columbus	Columbus Buggy Co., Columbus, O.	Roadsters, Touring Cars, 4-cyl., 30 *t*, and 40 *t*, and 6-cyl. 58 *t*., (prices on application)								
Flanders "Sixes"	Flanders Motor Co, Detroit, Mich.				40 *t*, $1,550	50 *t*, $2,250				
Ford	Ford Motor Co., Detroit, Mich.	22 *r*, $525	22 *t*, $600							
Franklin	H. H. Franklin Mfg. Co., Syracuse, N. Y.				18 *r*, $1,650		30 *t*, $2,900	38 *t*, $3,600	38 *lim*, $4,850	
Garford	The Garford Co., Elyria, O.						6-cyl. *t*, $2,750	6 cyl, *lim*, $3,750		
Glide	Bartholomew Co., Peoria, Ill.				40 *t*, $1,690	45 *t*, $2,250				
Grant	Grant M. C. Co., Cleveland, O.						50 *rd-t*, $2,750			
Great Western	Great Western Auto. Co., Peru, Ind.				40 *rd-t*, $1,585					
Grout	Grout Auto. Co., Orange, Mass.				32 *t*, $2,000		36 *t*, $2,850			
Halladay	Streator M. C. Co., Streator, Ill.			23 *t*, $1,100			32 *rd*, $2,750			
Havers	Havers M. C. Co., Port Huron, Mich.				44 *rd-t*, $1,850	55 *rd-t*, $2,250				
Haynes	Haynes Auto. Co., Kokomo, Ind.				2-4-5 p, $1,785	40 *rd-t*, $2,250		40 *lim*, $3,400		
Henderson	Henderson M. C. Co., Indianapolis, Ind.			45 *rd-t*, $1,485	45 *rd-t*, $1,585					
Herreshoff	Herreshoff Motor Co., Detroit, Mich.			30 *rd*, $1,250	36 *t*, $1,850					
Hudson	Hudson M. C. Co., Detroit, Mich.				37 *rd-t*, $1,875	54 *t*, $2,450				
Hupmobile	Hupp M. C. Co., Detroit, Mich.		20 *r*, $750	6p, *t*, $1,175						
Imperial	Imperial Auto. Co., Jackson, Mich.			40 *t*, $1,285	45 *t*, $1,650					
Inter-State	Inter-State Auto. Co., Muncie, Ind.				32 *rd-t*, $1,700	40 *rd-t*, $2,400		50 *rd-t*, $3,400		
Jackson	Jackson Auto. Co., Jackson, Mich.			35 *t*, $1,500	45 *t*, $1,975	55 *t*, $2,500				
Keeton	Keeton M. Co., Detroit, Mich.						48 "Six," $2750			
Kelsey	Kelsey Car Corporation, Connersville, Ind.					"Six" *t*, $2,375.				
King	King M. C. Co., Detroit, Mich.			23 *rd-t*, $1,190						
Kissel Kar	Kissel M. C. Co., Hartford, Wis.				30 *t-rd*, $1,700	50 *t*, $2,500		60 *t-rd*, $3,150	60 *lim*, $4,900	
Kline Kar	Kline M. C. Corp, Richmond Va.				30 *rd-t*, $1,850	40 *rd-t*, $2,250	50 *rd-t*, $2,850	60 *rd-t*, $3,250		
Knox	Knox Auto. Co., Springfield, Mass.								60 *t*, $5,000.	
K-r-i-t	Krit M. C. Co., Detroit, Mich.		25 *rd-t*, $900							
Lambert	Buckeye Mfg. Co., Anderson, Ind.			27 *rd-t*, $1,200	35 *t*, $1,650					
Lenox	Lenox M. C. Co., Boston, Mass.				40 *rd-t*, $2,000		60 *t*, $2,750			
Little Four	Little M. C. Co., Flint, Mich.		20 *rd*, $750							
Locomobile	Locomobile Co , Bridgeport, Conn.							41 *rd-t*, $3,600	60 *rd-t*, $4,300	82 *lim*, $6,000
Lozier	Lozier M. C. Co., Detroit, Mich.							52 *t-r*, $3,250	88 *t-rd*, $5,000	88 *lim*, $6,500
McFarlan Six	McFarlan M. C. Co., Connersville, Ind.					45 *rd-t*, $2,300	60 *t*, $2,750	50 *rd-t*, $3,700.		
McIntyre	McIntyre Co, Auburn, Ind.			26 *t*, $1,125						
Marathon	Marathon M. Wks., Nashville, Tenn.		25 *rd*, $875	35 *t*, $1,350	45 *t*, $1,750					
Marion	Marion M. C. Co., Indianapolis, Ind.			30-40 *t*, $1,475	48 *t*, $1,850					
Marmon	Nordyke & Marmon Co., Indianapolis, Ind.						32 *t-r-lim*,$3000		48 *t-r-lim*, $5,000	
Matheson	Matheson Auto. Co., Wilkesbarre, Pa.								50 *t*, 5-7p, $4,800.	
Maxwell	Maxwell-Brisco Co., Tarrytown, N. Y.		22 *rd*, $785	30 *t*, $1,145	40 *t*, $1,675					
Mercer	Mercer Auto. Co., Trenton, N. J.						32 *t*, $2,900			
Metz	Metz Co., Waltham, Mass.	22 *rd*, $595	22 *rd*, $495							
Michigan	Michigan M. C. Co., Kalamazoo, Mich.				40 *rd-t*, $1,585					
Midland	Midland M. Co., Moline, Ill.				32 *t*, $2,000					
Mitchell	Mitchell-Lewis M. Co., Racine, Wis.			40 *rd-t*, $1,500	50 *rd-t*, $1,850	60 *t*, $2,500				
Moline	Moline Auto. Co., East Moline, Ill.				40 *rd-t*, $1,950					
Moon	Moon M. C. Co., St. Louis, Mo.			30 *r-rd-t*, $1,385	48 *r-rd-t*, $1,985	65 *r-rd-t*, $2,500				
Moyer	H. A. Moyer, Syracuse, N. Y.					32 *t*, $2,500	40 *t*, $3,000			
National	National M. Veh. Co., Indianapolis, Ind.						40 *rd*, $2,750			
Norwalk	Norwalk M. C. Co., Martinsburg, W. Va.							"Six" *t*, $3,100		
Nyberg	Nyberg Auto. Wks., Anderson, Ind.			37 *t*, $1,295	45 *t*, $1,750					
Oakland	Oakland M. C. Co., Pontiac, Mich.		35 *rd*, $1,000	40 *t*, $1,450	42 *rd-t*, $1,600	60 *rd-t*, $2,400	60 *lim*, $3,000			
Ohio	Crescent M. C. Co., Cincinnati, O.					25 *rd-t*, $2,500				
Oldsmobile	Olds Motor Wks., Lansing, Mich.					36 *rd-t*, $2,500		40 *t*, $3,200	60 *rd-t*, $5,000	60 *lim*, $6,000
Overland	Willys-Overland Co., Toledo, O.		30 *t*, $985							
Packard	Packard M. C. Co., Detroit, Mich.		25 *r-rd t*$950				18 *t*, $2,800	30 *t*, $3,700	48 *t*, $4,850	48 *lim*, $5,850
Paige-Detroit	Paige-Detroit M. C. Co., Detroit, Mich.			36 *r-rd*, $1,275						
Palmer-Singer	Palmer & Singer Mfg. Co., Long Island City				45 *rd-t*, $2,000		60 *rd-t*, $3,000			
Pathfinder	Motor Car Mfg. Co., Indianapolis, Ind.					40 *rd-t*, $2,185.				
Patterson	W. A. Patterson Co., Flint, Mich.			25 *t*, $1,250	27 *t*, $1,800					
Peerless	Peerless M. C. Co., Cleveland, O.								38 *t*, $4,300	60 *t*, $6,000
Penn	Penn. M. C. Co., New Castle, Pa.		22 *rd*, $1,000	27 *t*, $1,400						
Perfex	Perfex Co., Los Angeles, Cal.			30 *rd*, $1,050						
Petrel	Petrel M. C. Co., Milwaukee, Wis.		22 *rd*, $850	30*t*,$1025-$1200						
Pierce-Arrow	Pierce-Arrow M. C. Co., Buffalo, N. Y.								38 *t*, $4,300	60 *t*, $6,000
Pilot	Pilot Car Sales Co., Richmond, Ind.				53 *t*, $2,000	59 *t*, $2,250				
Pope-Hartford	Pope Mfg. Co., Hartford, Conn.					40 *rd-t*, $2,250		50 *rd-t*, $3,250	60 *rd-t*, $4,250	60 *lim*, $5,550
Pratt	Elkhart Carr. & H. Mfg. Co., Elkhart, Ind.				32 *r-t*, $2,000					
Premier	Premier Motor Mfg. Co., Indianapolis, Ind.						Lt.6*rd-t*, $2735	Big 6,*rd-t*, $4000		
Pullman	Pullman Motor Car Co., York, Pa.				36 *rd*, $1,675	44 *rd*, $2,150	66 *rd*, $2,750.			
R.-C.-H.	R.-C.-H. Corporation, Detroit, Mich.		25 *rd-t*, $900	25 coupé, $1,300						
Rayfield	Rayfield M. C. Co., Springfield, Ill.					41 *rd-t*, $2,500				
Rambler	T. B. Jeffrey Co., Kenosha, Wis.				42 *t*, $1,875		42 *lim*, $2,825			
Raymond	Raymond Eng. Co., Hudson, Mass.	22 *r*, $445								
Regal	Regal M. C. Co., Detroit, Mich.		25 *t*, $950	35 *t*, $1,400						
Reo	Reo M. C. Co., Lansing, Mich.			35 *rd-t*, $1,095						
Republic	Republic M. C. Co., Hamilton, O.					35 *rd-t*, $2,350				
Schacht	Schacht M. C. Co., Cincinnati, O.				45 *t-r*, $1,850					
Sebring	Sebring M. C. Co., Sebring, O.						30 *t*, $2,750			
Selden	Selden M. Veh. Co., Rochester, N. Y.					36 *rd-t*, $2,500	36 *t*, $2,750	36 *lim*, $3,750		
Simplex	Simplex Auto. Co., New York City									50 *t*, $6,200
Speedwell	Speedwell M. C. Co., Dayton, O.						40 *t*, $2,700			
Spaulding	Spaulding Mfg. Co., Grinnell, Iowa				30 *t*, $1,650					
Stanley (steam)	Stanley M. Carrg. Co., Newton, Mass.			10 4p, *t*, $1,300	20 *t*, $1,700	30 *t*, $2,500				
Stayer	Stayer Carriage Co., Chicago, Ill.				45 *t*, $1,875	55 *t*, $2,250	65 *t*, $2,750			
Stearns	F. B. Stearns Co., Cleveland, O.								30 *t*, $4,750	30 *lim*, $5,750
Stevens-Duryea	Stevens-Duryea Co., Chicopee Falls, Mass.								*rd-t*, $4,500	30 *lim*, $5,500
Stoddard-Dayton	Dayton M. C. Co., Dayton, O.			30 *t*, $1,450	38 *t*, $1,850		48 *t*, $2,800		"Knight," $5,000	
Studebaker	Studebaker Corp., Detroit, Mich.		25 *t*, $885	30 *t*, $1,100	40 *t*, 6-*cyl*,$1,550					
Stutz	Ideal M. C. Co., Indianapolis, Ind.				50 *rd-t*, $2,000	60 *t*, $2,300				
S. G. V.	S. G. V. Co., Reading, Pa.					25 *t-r*, $2,500		35 *t*, $3,600		
Vaughan	The Vaughan Car Co. Inc., Kingston, N.Y.							25 *t*, $3,600		
Velie	Velie M. Veh. Co., Moline, Ill.			32 *rd-t*, $1,500	40 *t*, $2,000	40 *t*, $2,500	40 *lim*, $3,000			
Warren	Warren M. C. Co., Detroit, Mich.			30 *t*, $1,300	35 *t*, $1,500					
Westcott	Westcott M. C. Co., Richmond, Ind.					22 *t*, $2,250		29 *t*, $3,300		
White	The White Co., Cleveland, O.				30 *t*, $2,500			40 *t*, $3,500	30 *lim*, $4,050	60-6 *c.l*, 6,300
Winton	Winton M. C. Co., Cleveland, O.						48 *r-t* $3,000	7 pas. *t*, $3,250	48 *lim*, $4,500	
Zimmerman	Zimmerman Mfg. Co., Auburn, Ind.			34 *rd-t*, $1,500	6 cyl *rd-t*, $2000					

Abbreviations used in the list.—Runabout, *r*; Roadster, *rd*; Touring Car, *t*; Limousine, *lim*; Horsepower, expressed by numeral giving the brake horse-power. Combinations such as *r-rd-t* signify that all three types sell at the same price.

Choose Your Car *Now*

NOW is the time to decide what car you are going to buy. The automobile shows bring all of the cars before you. You have a chance to study them—to compare them point by point.

We do not expect you to buy a Chalmers car simply on our word that it is the best value at the money. Although many people do accept our word in the matter and we know it is good. But you will want to see all of the cars and to compare them as to quality and as to price. This is natural and right.

Let Us Prove Chalmers Quality

We believe, however, that Chalmers cars possess qualities that make them the best value in their price class. We believe Chalmers cars are the best cars for you to buy, and all we ask is an opportunity to prove to you that the things we say about Chalmers cars are true.

In such points as comfort, beauty, convenience, we know that Chalmers cars will compare favorably with even the highest priced. They have all the "features" that modern motorists demand—self-starter, electric lights, long stroke motor, demountable rims, four-forward speed transmission, speedometer, power tire inflater, etc.

How to Judge Motor Cars

But there are certain other ***qualities*** which you should demand. You should look for them in all the cars you consider. We ask you to make these qualities your standard in buying any car, whether or not it be a Chalmers.

As you study the cars at the National shows or in the dealers' sales rooms, compare them not only as to comfort, beauty, convenience and mechanical excellence, but also as to the following points:

1. **Stability of company marketing car.**
2. **How long have they been in business?**
3. **Do they manufacture or merely assemble?**
4. **What do the owners say about the car?**
5. **Has the car itself merely features or is real quality built into it?**
6. **Will it command a good price in case you care to sell it two or three seasons hence?**

Consider the prices of cars ***only in relation to their quality.*** You can pay too little to make a wise investment. You can also pay too much.

Why Chalmers is Best Value

Here are some specific facts showing why it is to your interest to pay the Chalmers price rather than lower prices. These same facts show why it is not necessary to pay more than the Chalmers price to get the maximum in motor car service and comfort.

Chalmers transmission gears are ground to an accuracy of ½ of 1/1000 part of an inch. This grinding alone makes Chalmers transmissions cost $8 more than they would if we did not grind the gears. But grinding means quietness, smoothness, long wear.

The Chalmers crank shaft costs $6 more than a crank shaft which "would do." But one fact that we are proud of is that we have never had a case of broken crank shaft. And so we spend that extra $6. The Chalmers crank shaft is of the same quality as the crank shaft used in the $4000 and $5000 cars.

We spend $15 more on each Chalmers body than we would have to spend if we used a cheaper material and the old-fashioned straight-sided instead of the full flush-sided bell-backed design.

Chalmers radiators cost $5 more per radiator than we actually need to pay to get a radiator that will keep the motor cool. We spend this extra $5 to buy the best radiator on the market.

We spend $1.50 more on our steering wheel to furnish an enameled aluminum spider and a mahogany rim in place of the usual maple rim with a cast or stamped iron spider.

None Better Than Chalmers

Chalmers steering connections are all drop forgings and are all heat treated. Highest priced cars do not contain better materials.

The mohair which is used in Chalmers tops is the highest grade material on the market. We could "save" $10 per car in top material alone and it would require a chemical analysis now to tell the difference. But anybody could tell the difference in a year from now.

We could buy leather for upholstering our cars $12 per car cheaper than we actually pay. This cheaper leather is used in many cars. You really can't tell the difference until the cars have run a while, and then you can very easily tell it. We spend this difference to secure a high grade, genuine leather.

The Turkish springs in Chalmers cushions cost $3.50 per car more than the ordinary spiral springs used in most medium priced cars.

Compare Chalmers with Others

Consider even so small a thing as piston rings. One Chalmers sectional piston ring costs as much to make as an entire set of the ordinary piston rings, even such as are used in some of the highest priced cars.

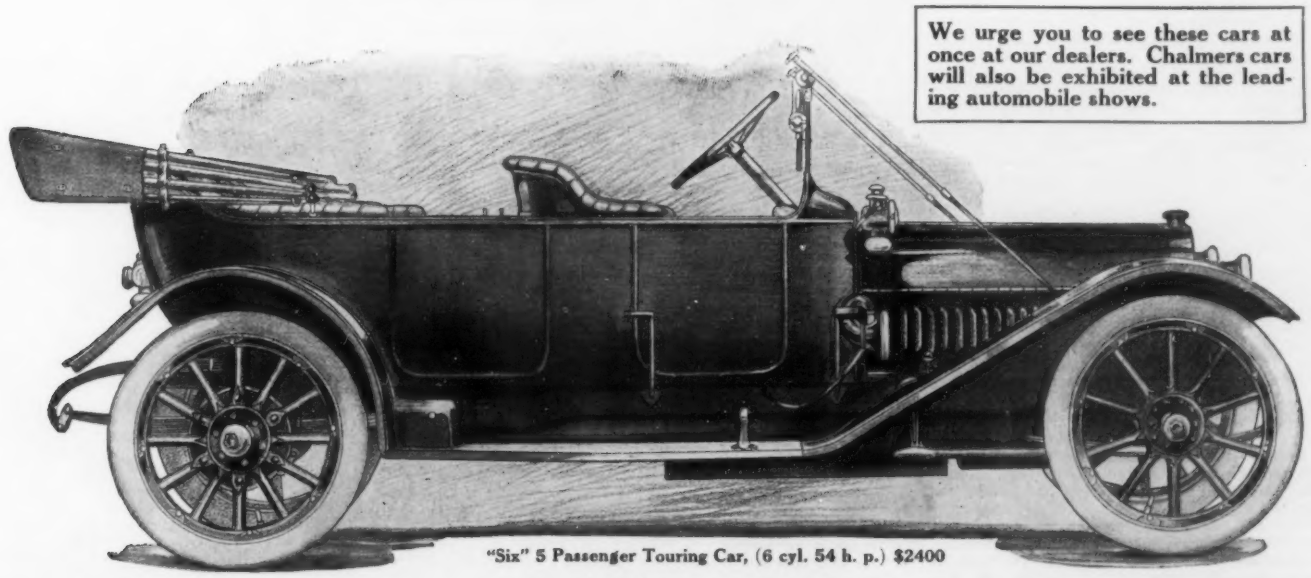
We mention these few items just to show you that we are making no exorbitant claims when we say that Chalmers cars are genuine quality cars at medium prices. We ask you to remember these things in making comparisons.

See the other cars, but do not buy until you have seen the Chalmers. Compare other cars in the Chalmers price class on the points we have named. We are willing to accept your decision after you have made such a comparison.

Our book "Story of the Chalmers Car" sent free on request, will help you in making your choice.

Chalmers Motor Company, Detroit

We urge you to see these cars at once at our dealers. Chalmers cars will also be exhibited at the leading automobile shows.



"Six" 5 Passenger Touring Car, (6 cyl. 54 h. p.) $2400

"Thirty-Six" (4 cyl. 36 h. p.) 2, 4 or 5 Passenger - $1950 **"Six" (6 cyl. 54 h. p.) 7 Passenger - - - - $2600** **"30" (4 cyl. 30 h. p.) 4 or 5 Passenger - - - - $1600**

(Prices include full equipment and are f. o. b. Detroit.)

What Electric Pleasure Car Can I Buy?

A Table Which Gives the Name, Manufacturer and Price of the Principal American Electric Pleasure Cars

Name of Car.	Name and Address of Manufacturer.	Under $2,500.	$2,500 to $3,000.	Over $3,000.
Argo	Argo Electric Vehicle Company, Saginaw, Mich		4p Rd., $2,500, 4p Bro., $2,800	Fore-Drive 5p $3,100
Bailey	S. R. Bailey & Co., Amesbury, Mass	2p Roadster, $2,250-$2,500	Phaeton, $2,600	4p Roadster, $3,200
Baker	Baker Motor Vehicle Company, Cleveland, Ohio	2p Victoria, $2,000	4p Coupé, $2,800	Brougham, $3,100
Borland	Borland-Grannis Company, Chicago, Ill	5p Brougham $2,500	3p Rd., $2,500, 5p Coupé, $2,900	7p Limousine, $5,500
Broc	Broc Electric Vehicle Company, Cleveland, Ohio	2p Stanhope $2,000, Vic. 2p 2,050	5p Brougham, $3,000	6p Brougham, $3,200
Buffalo	Buffalo Electric Vehicle Company, Buffalo, N. Y		2p Roadster, $2,600	2p Coupé, $3,200
Century	Century Electric Car Company, Detroit, Mich		5p Brougham, $2,550	
Chicago	Chicago Electric Motor Car Company, Chicago, Ill		"131" Coupé, $2,800	"132" Coupé, $3,100
Church-Field	Church-Field Motor Company, Detroit, Mich	2p Roadster, $2,300	Brougham, $2,800	
Colonial	Colonial Electric Car Company, Detroit, Mich		5p Brougham, $2,700	
Columbus	Columbus Buggy Company, Columbus, Ohio			
Dayton	Dayton Electric Car Company, Dayton, Ohio	2p Victoria, $2,100	4p Coupé, $2,700	
Detroit Electric	Anderson Electric Car Company, Detroit, Mich	2p Roadster, $2,350, Vic., $2,300	4-5p Brougham, $3,000	5p. C.V. Brougham, $3,600
Flanders	Flanders Manufacturing Company, Pontiac, Mich	4p Victoria, $2,250	4p Coupé $2,500	
Fritchle	Fritchle Auto and Battery Company, Denver, Colo	2p Roadster, $2,100	4p Touring, $2,500	4p Coupé, $3,600
Grinnell	Grinnell Electric Car Company, Detroit, Mich		5p Coupé, $2,950 Broug'm $3,000	
Kimball	C. P. Kimball & Co., Chicago, Ill		2p Phaeton, $3,000	
Ohio	Ohio Electric Car Company, Toledo, Ohio	3p Victoria, $2,300	5p Coupé, $2,900	5p Brougham, $3,200 and $3,500
Hupp-Yeats	R-C-H Corporation, Detroit, Mich	4p Regent, $1,750		
Rauch & Lang	Rauch & Lang Carriage Company, Cleveland, Ohio	4p Victoria, $2,500	4p Coupé, $2,900, 5p Bro. $3,000	
Standard Electrique	Standard Electric Carriage Company, Jackson, Mich	4p Coupé, $1,885	5p Coupé, $2,250	
Studebaker	Studebaker Corporation, South Bend, Ind	"17" Stanhope, $850		
Van Wagoner	Clark Motor Carriage Company, Buffalo, N. Y	2p Roadster, $1,800	Coupé, $2,200	5p Coupé, $3,000
Waverley	The Waverley Company, Indianapolis, Ind	2p Roadster, $2,250		5p Limousine, $3,500
Woods	Woods Motor Vehicle Company, Chicago, Ill	2p. Rd., $2,400, 4p Vic. $2,500	5p Brougham, $2,700	4p Lim., $3,100, 5p Lim. $3,600

The Trend in Automobile Construction

The Views of Automobile Engineers and Designers

Some weeks ago the Editor of the SCIENTIFIC AMERICAN *sent out a letter to the members of the Society of Automobile Engineers in which they were asked to give their views on present tendencies in automobile design. Through lack of space it is impossible to publish all the replies received. Moreover, automobile engineers are fairly well agreed on the present tendencies, so that there would be considerable repetition were all the replies printed. It has been deemed advisable to select from the many letters received those which seem to express the views of most designers. In this selection subject matter has been considered, rather than the personality of the writer. More replies appear in the current issue of the* SCIENTIFIC AMERICAN SUPPLEMENT.—EDITOR.

We believe present tendencies in design and construction are for smaller motors, higher speed and more efficiency than found in the present type of motor, motors that would compare with the better design of motors on the other side, small, high-speed, highly efficient motors are used. This seems to be a vital subject, as the price of gasoline is steadily going up and, therefore, the economy must be closely watched. Also, there is a very strong demand for automobiles using a high grade of kerosene or a low grade of gasoline, and this is something that must be met and handled by the engine builders, as well as the carburetor manufacturers.

GEORGE T. BRIGGS,
Indianapolis. Wheeler & Schebler.

The electric starter is giving the engineer considerable concern. The electric starter must be reliable, self-controlled and above all fool-proof. It must be large enough to crank the motor rapidly, and yet as small as possible in order to keep down weight. The charging and lighting dynamo, whether it be one unit with the starting motor or a separate machine, must have sufficient capacity to keep the battery fully charged at all times, and must, of course, be small enough to keep down weight. It becomes evident then that the ideal electric equipment is the combination of the charging dynamo with the starting motor in one unit, thus giving one half the added weight.

CHARLES BRYDEN, *Chief Engineer*,
Indianapolis, Ind. American Motors Company.

The automobile manufacturer is giving his careful attention to the public demands for a comfortable noiseless car, particular attention being given to self-starter, the tendency being in favor of the electric self-starter.

The manufacturer to-day is giving greater attention to the analysis of metal used, and in most instances specifies his own analysis as he has learned by practical experience that certain analyses give better results for his particular kind of work.

P. J. LEGAIR,
Detroit, Mich. Heinze Electric Company.

First of all the present tendencies in the design of engines is in the application of the long stroke and some type of piston or "sleeve" valve to replace the poppet types. In regard to the design of carburetors, which is, of course, another important problem that confronts automobile engineers most strongly, is the adaptation of present successful types to operation with kerosene or at least liquid fuels heavier than gasoline. Variations in the design of the valves are, however, very insignificant in comparison with remodeling of the carburetors for automobile engines. This tendency is observed on every hand by the widespread interest in all sorts of devices being proposed for using heavier liquid fuels and by the improvements made in most of the 1913 models of carburetors for heating the mixing chamber either with the hot water from the jackets or with the exhaust gases.

J. A. MOYER,
Professor of Mechanical Engineering,
State College, Pa. Pennsylvania State College.

The most vital problem to-day in the gasoline automobile is the necessity of being able to burn the poor grades of fuel. The greatest want to-day is the ability to burn kerosene successfully in the present automobile engine. The most serious problem to-day is the lack of gasoline. 1913 and 1914 will be more serious in this respect than at present.

H. S. HOMMY,
Waukesha, Wis. Waukesha Motor Company.

One of the problems that seems of great and almost imperative importance, and in which the requirements for a solution are continually becoming more pressing, is, of course, the carburetor and fuel supply.

The difficulties are known, but the incentive to remedy them does not seem to be sufficient. Many data are required before the engineer may command this subject. The data are wanting. The defects are known, but the remedies not. The law of diffusion of vapors is but little understood, and if it were understood, the engineer does not know what sort of vapors he is dealing with. The relations between the carburetor and the motor and different speeds of the motor, length of the intake pipe and such matters have not been thoroughly investigated.

Detroit, Mich. E. J. STODDARD.

The present day demands of the owner driver in the order of their importance are as follows: Electric lighting, self-starting motor, magneto ignition, extreme quietness at all speeds, flexibility of control, maximum ease alighting from driver's seat, convenience of minor controls, ability to completely lock up car, liberal oil storage for hundreds of miles of running.

Accessories.—Top capable of raising and lowering without help and curtains lowered from within. Glass front adjustable from completely lowered to rain vision. Demountable rims with extra rims, casings and tubes.

Chicago, Ill. R. M. NEWBOLD.

From the manufacturers' standpoint, the present tendencies in design and construction may best be summed up as developing along two lines: (*a*) the more economical use of material; (*b*) the more economical distribution of material.

By the more economical use of material, we mean the use of such special alloys or specially treated materials as shall produce a car which is more durable, requires less attention and weighs less for a given carrying capacity. By the more economical distribution of material, we mean the careful study of design in every part of the car in order that the best material for any particular part shall be used in that part, that no more shall be used than is requisite to have it perform its due and proper functions.

A. P. BRUSH, *Consulting Engineer*,
Flint, Mich. General Motors Company.

As to present tendencies in carburetor design, in Europe they have done away with the spring air valve, and all have all the air entering past the point of fuel flow. This tendency is being widely felt in this country, and the makers are gradually coming to this type.

The public are demanding carburetors which start easier and keep on running even after motor and carburetor are very cold.

GEORGE M. HOLLEY, *President*,
Detroit, Mich. Holley Brothers Company.

The latest field for experiment on the part of the engineering department is demountable wire wheels. It is the writer's opinion, however, that this foreign feature will eventually consist of non-demountable wire wheels, fitted with demountable rims for quick detachable tires, because the expense of additional spare wheels, as well as the weight, more than compensates for the advantages resulting from the use of wire wheels.

Among the advantages of wire wheels compared with wood or pressed steel wheels, are increased tire wear, due to the resiliency of wire wheels, and improved appearance of the car. The subject of braking all four wheels has been discussed a number of times by American engineers, but has not found favor in this country, and is losing favor abroad.

Relative to bodies, the growing tendency is for straight line, flush side construction, with a stream line effect in order to reduce wind resistance to a minimum.

New York, N. Y. JOSEPH A. ANGLADA.

I feel that the present tendencies in design and construction, if left to the manufacturer would be simplification of parts and ease of assembly. The demands of the public, however, preclude the possibility of working very far in this direction.

There seems to be a tendency to use wire wheels. I hardly think that the demand for this, however, is caused by any trouble that the wood wheel has given, but it is due more to a desire for something newer. It is a fact, however, that some of the larger concerns in England are putting more than half of their product on wire wheels.

C. A. TRASK (Per R. P.), *Assistant General Manager*,
Indianapolis. Henderson Motor Car Company.

It seems to me that the most vital problems are the development of engines and carburetors to use kerosene and alcohol successfully; a simple and successful substitute for the poppet valve, the proper design and lubrication of small bearings and linkage joints.

It seems to me that with the substitution of a simple and successful sleeve or rotary valve, the addition of means for using a heavy fuel, and adequate protection and lubrication for small wearing parts, the present moderate-priced machines would be all that could be desired.

D. W. SMITH, *Member S. A. E.*,
Washington, D. C. Brock, Becken & Smith.

The present tendencies in design and construction are toward quietness, simplicity of arrangement of parts, luxuriousness and electrical improvements.

The public demand is for higher powered cars, 6 cylinders, electric lighting, easy riding, full equipment and accessibility.

The demands of the public must be met by decrease in the cost of production without sacrificing the quality of the cars produced, better design from the standpoint of the engineer, reduction of selling costs and standardization of certain parts.

The vital problems in automobile construction are those affecting the maintenance of the car, such as carburetors, transmission gearing, lubrication and tires.

Every concern should pay special attention to the establishment and maintaining of a properly equipped laboratory under the supervision of an engineer who has been thoroughly trained in the theory and practice of motor car construction, both at home and abroad.

W. C. MARSHALL,
Assistant Professor of Machine Design,
Sheffield Scientific School of Yale University.
New Haven, Conn.

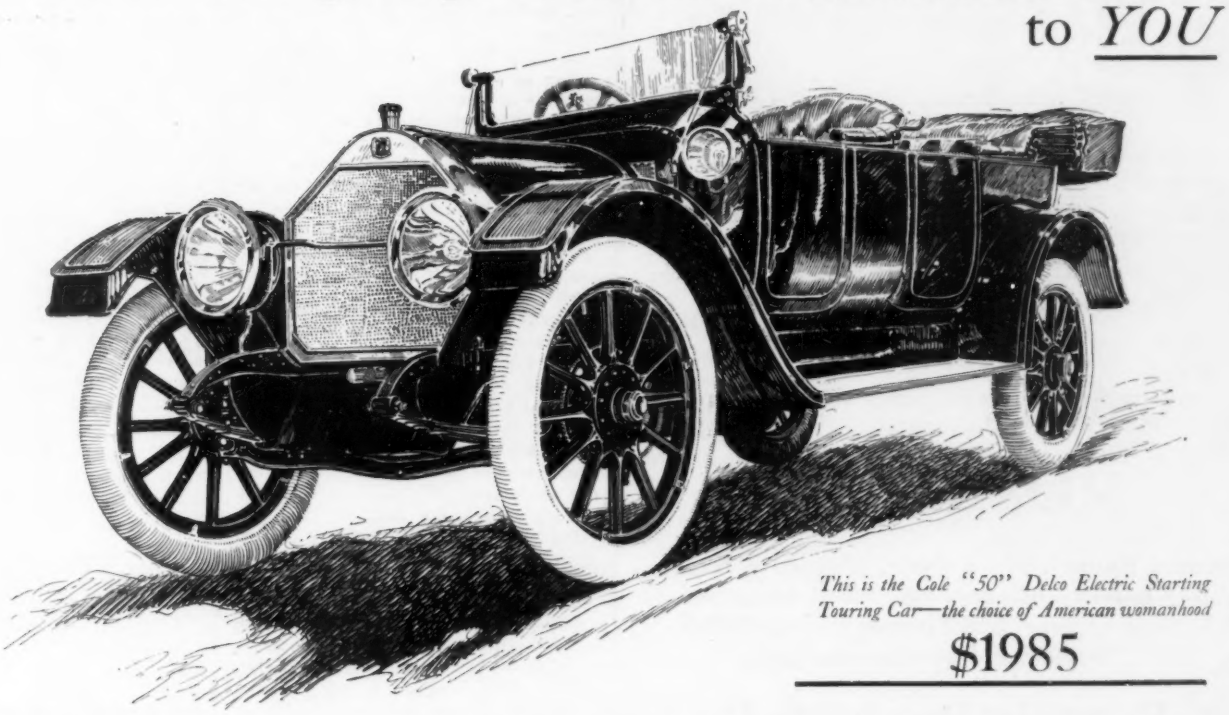
The tendency of the automobile construction, at the present time, appears to be the substitution of spline shafts for square shafts in transmission boxes. This is desirable, in a general way, provided the making of the shaft and the gear is carried out on correct lines; that is, the spline shaft should be made so that the surfaces between the splines run true with the bearings, and then the hole in the gear could be ground to proper diameter to fit this shaft at its smallest diameter and accurate results can be obtained.

There is a tendency among some of the manufacturers to have the gear make contact on the tops of the splines, because this surface can be easily machined by putting the shaft in a plain grinder and grinding the tops of the splines after the shaft has been hardened or heat-treated.

The ideal way, we believe, is to finish the spline shafts accurately between the splines either by a second milling operation or by a grinding operation, and then design the gear to fit on this surface and not fit on the tops of the splines. By so doing, the gear can be ground to accurate diameter on an internal grinding machine and perfect fits are sure, together with accurate workmanship and quiet running operation.

JAMES N. HEALD,
Worcester, Mass. The Heald Machine Company.

Leave comfort, convenience and beauty lines to *her* —she is leaving the price and mechanical correctness to *YOU*



This is the Cole "50" Delco Electric Starting Touring Car—the choice of American womanhood

$1985

MAKE the purchase of your next motor car a domestic business transaction. Recall how you and the wife built the home? You bought the lot where values were right and selected the architect on the strength of his reputation. You watched the plumbing—you planned the heating plant. You demanded nothing but "bests" in the entire construction.

You left the social environment, the convenience and the interior decorations to her—this was *right*. When it was all done two things had been satisfied—a woman's intuitive appreciation of beauty and a man's cold business judgment. It's a combination that can't be beat—take it with you when you go to buy your next motor car.

The character study of the Cole Motor Car at the top of this advertisement is for her eye—not yours. Dry tabulated specifications are for you and you alone. After careful investigation of the Cole and other cars as well, your preference will be--

The New Series 8—"50"

COLE

Its Principles of Construction

Silent Cole unit power plant with three point suspension and all working parts enclosed. A motor free from grease cups, with automatic lubricating system and combination thermo-syphon and force pump water circulation. Timken front and full-floating rear axle with large Timken bearings. Large brake drums on wheels equipped with Firestone demountable rims, 122-inch wheel base. Gasoline pressure tank and tire rack in rear. Straight line body with concealed hinges and locks. Deep Turkish, hand buffed leather upholstery. Silk mohair top. Clear vision ventilating windshield and speedometer with grade indicator. Solar electric lamps—nickel-silver trimmed. Price for Cole "50," completely equipped, $1985.

In addition to the "50" the Cole comes in two other classes: Cole "40," 116-inch wheel base, price, completely equipped, $1685; and the Cole six cylinder "60," price, completely equipped, $2485

No difference in quality—merely diamonds of varying karat.

Cole Motor Car Company

Indianapolis, Indiana

Tell her that you can "see" the Cole at the New York Show in January or at the Chicago Show in February

"So far so good"—you say

All right. Now let's fill out this coupon. It doesn't obligate you. Back will come the Cole Blue Book for "her"—the Technical Bulletin for you. Your business judgment will prompt you to send the coupon by return mail—before you lay this magazine aside.

"OUR" COUPON REQUEST

COLE MOTOR CAR CO., INDIANAPOLIS

We have decided that the Cole is worth investigating. It is understood that we assume no obligation in asking for the Cole Blue Book and the Technical Bulletin—so send by return mail, postpaid.

"Her" Name _____

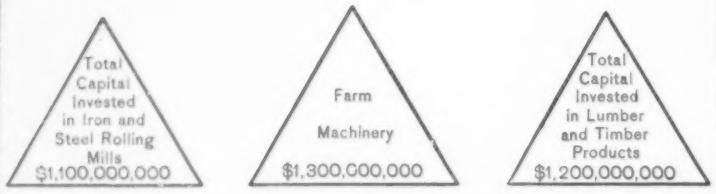
"My" Name _____

Address _____

COLE Bonus Est

Rumely Bulletin No. 6

Farming *à la Factory*


Total Capital Invested in Iron and Steel Rolling Mills $1,100,000,000
Farm Machinery $1,300,000,000
Total Capital Invested in Lumber and Timber Products $1,200,000,000

Nine-tenths of the work on a farm is now done by machinery, not by muscle.

There is now more than 2,000,000 horse-power on American farms in mechanical power.

The total value of our farm machinery is $1,300,000,000.

Here you have the secret of our $9,000,000,000 crops.

The wealth of our 6,400,000 farms is more than $41,000,000,000. The average farm is now worth $6,400.

Such are the results of farming *à la factory*, which have been brought to pass by such men as

RUMELY

Meinrad Rumely, of La Porte, founded a farm machinery industry 60 years ago, which has grown into 5 factories and over 6,000 people, making OilPull Tractors and 50 other machines.

Rumely Products Co.
(Incorporated)
Power-Farming Machinery
La Porte, Ind.

See next week's Bulletin

380

SHAVING NECESSITIES

Until you use ***3-in-One*** oil on your "safety" or "ordinary" razor and your strop, you will never know what **real** shaving is. Don't scoff! Try it at our expense and be convinced.

To have a **perfect** shave do this: Draw your safety or ordinary blade between your thumb and forefinger moistened with a little ***3-in-One*** oil. Put 3 drops on your strop. Then strop as usual and secure a wonderfully keen cutting edge!

After shaving, **again** draw the blade between oil moistened thumb and forefinger. Then no dulling rust can form between shaves. This is the reason: You can't wipe the minute "teeth," which form the shaving edge of every razor, dry enough to prevent moisture from the lather remaining. But ***3-in-One*** oil will absolutely counteract all its rusting effects. Send for **free** scientific "Razor Saver" circular and learn how to take proper care of your razor.

Always oil your gun, revolver, fishing reel, talking machine with ***3-in-One*** —**everything** else around your house and office that ever needs oiling. ***3-in-One*** also cleans and polishes; and prevents rust indoors or out

FREE Try before you buy. Write **today** for generous free sample and the ***3-in-One*** Dictionary.

For sale everywhere in 3 size bottles: 1 oz., 10c; 3 oz., 25c; 8 oz.-½ pint, 50c. Also in Handy Oil can (patented), 3½ oz., 25c.

Three-in-One Oil Co., 42-ZB Broadway, New York

An Ingenious Overheating Tell-tale

ALTHOUGH the automobile motor admittedly is a heat engine, and as such requires to operate at temperatures which under ordinary conditions would be considered comparatively high, it still is essential that this temperature be controlled within well-defined limits if the motor is to operate at its maximum efficiency.

In other words, the amount of heat that is dissipated, or, figuratively speaking, lost, determines the thermal efficiency of the motor. If the motor runs too cool, its efficiency will be low, as will be directly visible in the increased amount of fuel required to generate a given amount of power. Theoretically, its thermal efficiency will increase in proportion to the temperature rise up to a certain limit when the permissible co-efficient of expansion of the metal parts is reached when there is danger that the pistons will "freeze" in the cylinders and cause damage that is costly if not irreparable. Needless to add, motors are particularly susceptible to danger of the kind during the summer season.

As a rule, the water cooling system can be relied upon absolutely to maintain a motor at the proper temperature for the best all around results. There are conditions, however, as when making long climbs on low gear, for instance, when the temperature rise may be abnormal. Also, a broken fan belt, of which the driver may have no knowledge, or a shortage of water in the radiator, may cause excessive heat.

To give the driver instant and visible evidence of such conditions, an ingenious radiator thermometer has been developed and recently placed on the market. In its simplest aspect, it consists of a short thermometer tube containing bright red liquid, mounted on a short scale with wide, plainly marked divisions. At the upper end of the scale, between the divisions 130 and 212 deg. Fahr., there is a round aperture, the purpose of which is to permit the driver to see the red fluid instantly it mounts higher than the division corresponding to a temperature of 130 degrees. At approximately 180 degrees, which is the normal operating temperature of the average motor, there are two arrows, one on either side of the scale, so arranged that the driver is made instantly acquainted with further temperature rises, which may be taken as an indication of improper driving or derangement in the cooling system.

The device is calculated to detect leaky radiators, water shortage, loose or broken fan belts, faulty lubrication, etc., all of which are conducive to over-heating. Incidentally, it should prove valuable in increasing fuel economy, for it is comparatively well known that very few motors are operated on the minimum amount of fuel; rich mixtures are one of the most prolific causes of excessive temperature rises.

The thermometer scale registers, also, down to the freezing point of water, and the instrument, therefore, should be useful in obviating the conditions which otherwise would result in the cooling system freezing up in cold weather. With its aid, the driver is enabled to tell at a glance just when to throw his robe over the radiator while waiting for passengers, or, instead of permitting his motor to run idly for long periods, thus reducing fuel economy, he can stop it until the temperature of the water as indicated by the instrument, becomes low enough for the motor to be started and run for a short time to heat the water above the danger point again.

The device can be attached to any motor merely by drilling a three eighths inch hole in the radiator cap and inserting the stem of the device through it.

The Automobile Bus in Europe

IN various parts of Europe the use of the autobus for passenger service is on the increase. We note that in Greece the government wishes to have the public service running as soon as possible between Tripolitza and Sparta and between Lamia and Karpenisson. In Paris the

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Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

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FREE SAMPLE goes with the first letter. Something new. Every firm wants it. Orders from $1.00 to $100.00. Nice pleasant business. Big demand everywhere. Write for free sample. Metallic Mfg. Co., 438 N. Clark, Chicago.

AQUATIC DEVICES

THE NE PLUS ULTRA LIFE-PRESERVER. Pat. Hollow aluminum ribs, strong flexible covering, noncorrosive air-valve, and fasteners. Self-inflating on adjustment. Weighs 1½ lbs. Folds 5x6 in. Water, acid, rust and rot proof. Practically indestructible. Assures safety and comfort in water. Convenient to travelers and lovers of aquatic sports. Price $5. Highly illustrated booklet 10c. Auto-Pneumatic Swimming Belt, Inc., 309 B'way, N. Y.

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GOOD SPECULATION.—An inventor will give half interest for funds to patent valuable improvements in a necessary and useful invention relating to Harvesters. Apply, Ideas, Box 773 New York.

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LOCAL REPRESENTATIVE WANTED. Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. National Co.-Operative Realty Company. H-378 Marden Building, Washington, D. C.

MISCELLANEOUS

MODEL AND FINE CLOCK TRAIN WORK. Estimates given. Work done by the hour or by contract. Waltham Clock Company, Waltham, Massachusetts.

COW OWNERS. Let us tell you about James Sanitary Stalls, Stanchions, Litter Carriers and Feed Carriers, two fine books free. See how to keep your barn cleaner with less work, prevent diseases, increase quantity and improve quality of milk—boost your profits. Greatest dairy barn improvements of the age. Write postal or letter request *now*. Address James Mfg. Co., J 70 Cane St., Ft. Atkinson, Wis.

INQUIRY COLUMN

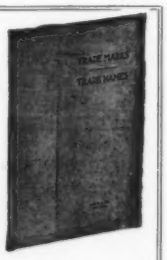
Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292. Wanted a gum that will stick labels to grape-fruit;

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth.

Inquiry No. 9294. Wanted to buy glass balls 1½ x 1¼" in diameter.

Trade Marks
Trade Names



Do you use a Trade Mark?
Do you own the Trade Marks you use?
You should read this booklet to obtain a definite and clear conception of Trade Mark rights

A TRADE MARK is a most valuable business asset. It will pay you to know how such marks are made valuable and why and how they are protected. The registration of trade marks is explained in this booklet which gives a thoroughly comprehensive idea of the requirements for registration. The elements of a good trade mark are fully discussed and many tests to determine the requisites of a desirable trade mark are given.

List of Chapters

Chapter I—The Trade Mark as a Business Asset. **Chapter II**—The Federal Trade Mark Law. (Classification of Merchandise). **Chapter III**—Analysis of the Requirements of Registration. **Chapter IV**—The Elements of a Good Trade Mark. **Chapter V**—Trade Mark Protection. **Chapter VI**—Practical Information (which should be furnished) the Trade Mark Attorney.

The booklet is printed in two colors and is illustrated by fifty engravings.

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Branch Office, Washington, D. C. — 361 BROADWAY, NEW YORK

Vitalized Rubber calls a halt on "Short Mileage!"

At last science gives you more rubber shod mileage.

Diamond (No Clinch) Tires

now made of VITALIZED RUBBER—a scientific combination of pure rubber and a toughening compound.

A perfect 3-Point Rim Contact tire at last

Fifty per cent of all tires are ruined through lack of perfect rim contact.

Perfect 3-Point-Rim-Contact is just as big an advantage in tire construction as 3-point suspension in the automobile.

Diamond 3-Point Rim Contact Tires hold with a vise-like grip absolutely preventing the tire from breaking above the rim, insuring no rim skid—no rim cutting—no rim trouble at all.

Our engineers have mastered the principles of Rim Contact construction, and you can get the Diamond (No-Clinch) Tire, with a perfect 3-Point Rim Contact—an important advantage that has been overlooked by all other tire makers.

You can get Vitalized Rubber in Diamond Tires—NOW

A tire containing too much rubber fails to give the necessary mileage because it is not tough enough to withstand road usage. And the tire containing too little pure rubber has not the necessary staying qualities.

Our chemists have discovered the secret of how to mix pure rubber and a toughening compound in just the right proportions. The result is additional mileage for you. The pure rubber we use comes direct from the trees of the tropics—it is fresh and contains all the vitality of youth—it is elastic and easy riding. Then we mix this pure rubber with the secret toughening compound, which gives it the necessary vitalizing, wearing, *more mileage* quality.

This scientific combination has been vainly sought after for years by tire makers. After 15 years of successful tire making we have solved the problem—and you enjoy the benefit of our really wonderful discovery—in "Diamond" Vitalized Rubber Tires.

Add to this the Diamond proven principles of proper construction—nothing inferior in rubber, fabric or workmanship—and you have as perfect a tire as money can buy.

Here is a combination of easy riding and more mileage advantages you can't get in any other tire today—*Vitalized Rubber, Perfect 3-Point-Rim-Contact, No-Pinch Safety Flap*, and, if you wish, the now famous Safety (Squeegee) Tread—made to fit all types of rims.

So this time specify "Diamonds"—you can get them at any one of the

25,000 Diamond Dealers always at your Service

No-Pinch Safety Flap absolutely protects the inner tube

The No-Pinch Safety Flap that comes in every Diamond (No-Clinch) Tire will cut your inner tube bills in half—because it forms a substantial wall separation between the inner tube and the rim, making it impossible for the inner tube to be pinched or cut under the rim, or injured by rim rust.

This No-Pinch Safety Flap is made of the best grade of fabric, and is finished with a "Feather Edge" as a further protection against inner tube cutting.

There is no rubber in this flap to adhere or vulcanize, so that the inner tube can be quickly and easily removed at all times—another big Diamond advantage.

NOTE—If you are not entirely satisfied with the mileage you are getting now—if you wish to reduce your tire upkeep—send today for our new book, "How to Get more Mileage Out of Your Tires." It is free to every tire user. No matter what tire you ride on, you simply cannot afford to be without this valuable book, so send the coupon today

Mail This Coupon TODAY

THE DIAMOND RUBBER COMPANY, Akron, Ohio. 107

If there is a way for me to get more mileage out of my tires, I would like to know it. Without obligation on my part, send me free and postpaid, by return mail, your new book, "How to Get More Mileage Out of Your Tires."

Name _____

Address _____

THE more you know about the automobile, the more reasons you find for choosing a Marmon. Side door and cast aluminum body construction, three point suspension, straight line shaft drive, positive force feed oiling through hollow crankshaft, pressed steel rear axle construction, double brakes on rear wheels, and many other features, used first in this country by the Marmon, are now used in many other high class cars. In the perfection of the best features of automobile construction, as well as in their origin, the Marmon stands foremost.

Detailed information given on request.

Nordyke & Marmon Co.
(Established 1851)
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Sixty Years of Successful Manufacturing

The Marmon "32"
32-40 h. p., 120-inch wheelbase, dependable electric starting and lighting system, left-hand drive, center control, nickel trimmings, with newest body types to meet every requirement and corresponding equipment $2,850 to $4,100.

The Marmon Six
48-80 h. p., 145-inch wheelbase, dependable electric starting and lighting system, left-hand drive, center control, nickel trimmings, with body types to meet every requirement and corresponding equipment $5,000 to $6,350.

Four simple movements do the work

ONE—Adjust dies to proper size by moving lower lever.

TWO—Throw upper lever to right to make ready for threading.

THREE—Insert pipe and hold in a genuine "Bulldog" Grip by throwing handle (not shown in cut) to right.

FOUR—After threading, throw upper lever to left and remove pipe without backing over thread—that's the simple story of the

OSTER BULLDOG DIE STOCK

It's told in complete form, with illustrations of each step, in our booklet: "The Bulldog Tale." This booklet shows you in a simple, straightforward way, how the Oster Bulldog does away with bothersome bushings, and all breakable small parts—it illustrates the simplicity of its self-locking dies, self-locking guides, and it makes it clear to you why the extreme simplicity and mechanical accuracy of this tool appeals to the mechanic who takes pride in his work. The booklet also gives you full prices on the Bulldog Line.

Every man who uses hand, motor, or power pipe-threading tools ought to read this book. It is yours by return mail. The attached coupon makes it easy.

THE OSTER MFG. CO.
1967 East 61st St.
Cleveland
Ohio
U.S.A.

MAIL THIS COUPON TODAY

I use stocks and dies for work. Please send me a copy of "The Bulldog Tale."

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City ..... State ..... (1967)

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WE have recently issued a new catalogue of scientific and technical books, which contains the titles and descriptions of 3500 of the latest and best books published, covering the various branches of the arts, sciences and industries.

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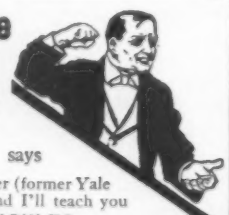
"Give Me 15 Minutes a Day!" says



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Converse Winningly
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Thousands of business and professional men have become convincing speakers in public and in business by following this Mail Course in their spare time at home or in their office. It has increased their power and influence—put them on the straight road to BIG SUCCESS.

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"If I were never to use an iota of this teaching and knowledge for the purpose of public speaking, still it is worth more than it costs, and is immensely valuable for the correction of an imperfect education—for the assistance it gives me in writing letters, in stating difficult business propositions, in the use of correct language. In addition, it broadens one's knowledge of literature, full import of statement, etc. I am wonderfully pleased."—W. T. Wilson (W. T. Wilson Grain Co.), Nacogdoches, Texas.

Without committing yourself in any way, send a post-card request at once for full particulars and proof of the value of the Kleiser Course in public speaking.

FUNK & WAGNALLS COMPANY, Dept. 648 New York

General Omnibus Company is now finishing the entire change-over, and the last of the double-deck horse vehicles are now disappearing. The figures for the last week of July showed 2,155 autobus running regularly in London, and 500 of these were put in use since the first of the year. The company is beginning to use several autobus of a new type for special service on renting by private parties, containing 27 or 34 places, and they are now running a new line which ends at Windsor, covering 12 miles in 1 hour and 18 minutes.

The New Vienna Museum of Technology and the Industrial Arts

THE first general assembly of the "Technisches Museum fuer Industrie und Gewerbe in Wien" met in the municipal council chamber of Vienna on December 1st. The meeting was attended by many manufacturers, scientists, technicians, financiers and public officials, whose interest in the new foundation had drawn them to the capital from all parts of the Austro-Hungarian empire.

The nature, purpose, preliminary history and present condition of the museum may be gathered from the addresses made by various speakers, including Arthur Krupp, chairman of the working committee which has had the affairs of the museum in its charge.

Herr Krupp, in his opening address, reminded his hearers that the Museum had been planned as a permanent memorial of the Jubilee Exposition held in Vienna in 1908, and that the establishment of such a museum had been suggested in 1907 by Dr. Brosche, then attached to the ministry of commerce, for the purpose of stimulating interest in the projected exposition, which appeared to be in danger of failure. The great industrial companies and firms adopted the suggestion with enthusiasm, and a working committee was formed to take charge of the preliminary work. The Imperial government granted the museum a subvention of 1,500,000 kronen ($305,000) and agreed to incorporate with it a number of important government collections. The city of Vienna contributed a suitable building site and a large sum of money.

The Imperial minister of commerce, after referring to the importance of technical progress for natural prosperity and the rapid and continuous transformation of industrial methods by the application of new advances in science and technology, welcomed the museum especially as evidence of the part pledged in these advances by Austrian investigators—a part often underestimated even in their own country. The speaker claimed the invention of the screw-propeller for the Austrian inventor, Ressel. He then spoke of the educational value of the museum, in which the progress of an invention can be followed from its crude beginning to its finished and practical form. Here the curious visitor and the embryo inventor will see the original Bell telephone beside the newest and most convenient desk instrument, the feeble little locomotive of old beside the latest, swiftest and most powerful giant of the rail, etc. The minister of commerce praised the generosity of the city of Vienna which had given a million kronen and land worth another million, and the 800 firms and individuals who had contributed more than two million kronen, this increasing the total endowment to 4.6 million kronen ($934,000). The government had chosen eminent men as its representatives in the boards of directors and curators, and had appointed Herr Arthur Krupp president of the board of curators.

President Krupp, before moving to proceed to the election of curators, stated that the universities, technical schools and scientific societies would have special representatives on the board, and that the general association of the museum already numbered 1,050 members.

The museum building is nearly completed, and the work of interior arrangement, equipment and installation of collections will probably be commenced within a few months.

Why Pay Garage Bills? **Get this Portable Fire-proof Garage**

A dignified and handsome building, absolutely fire-proof, weather-proof, strong and durable. A credit to any residence property. The ideal modern home garage. Keeps your car safe at home—at hand when you want it.

Pruden System

of interlocking, rustless metal units used only in our buildings. Easily erected. Easily taken down. Used by thousands of pleased owners. Any size or design. Doors and windows arranged as desired.

Efficiency—Pruden System Buildings combine perfect protection, beauty, economy and durability. Designed by skilled architects. Built by master mechanics. You will find them adapted to your needs as well as any home-made garage.

Economy—Initial cost is moderate—soon covered by what you save in rent. No home-made garage that will compare in value can be built for anything like the cost. Prices $100 up.

Durability—Years of service have proven their indestructibility. Made of rustless metal—they last a life time.

Write for illustrated catalog showing many designs for Garages, Offices, Stores, Warehouses, Construction Camps, etc.

METAL SHELTER CO.
5-52 W. Water St. St. Paul, Minn.
Patentees and Sole Manufacturers of Pruden System Buildings

$92.50—Our Price for Next 30 Days!

We now offer the Edwards "Steelcote" Garage (1913 Model), direct-from-factory, for $92.50. But to protect ourselves from advancing prices of steel, we set a time limit upon the offer. We guarantee this record price for 30 days only. Just now we can save you $35 or more.

Edwards Fireproof GARAGE
Quickly Set Up Any Place

An artistic, fireproof steel structure for private use. Gives absolute protection from sneak thieves, joy riders, fire, lightning, accidents, carelessness, etc. Saves $20 to $30 monthly in garage rent. Saves *time, work, worry and trouble.* Comes ready to set up. All parts cut and fitted. Simple, complete directions furnished. Absolutely rustproof. Joints and seams permanently tight. Practically indestructible. Locks securely. Ample room for largest car and all equipment. Made by one of the largest makers of *portable* fireproof buildings. Prompt, safe delivery and satisfaction guaranteed. Postal sent to-day brings new 56-page illustrated Garage Book *by return mail.*

THE EDWARDS MANUFACTURING CO.
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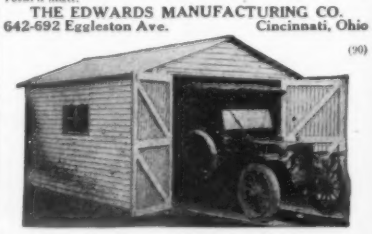


Build Your Own Boat

Build your own boat by the Brooks System. We shape and fit the parts—then ship to you. All you need do is nail them together—simple directions—you are certain to have as staunch and handsome a boat as the best builder could turn out. You save 2/3 of his price. Knock-down frame and patterns for 25-foot motor boat, only $25. If you can handle a hammer, saw and screw driver you'll be successful. We guarantee you satisfaction or return your money.

Write for Brooks Boat Book

describing scores of row boats, canoes, sail and motor boats, 72 pages, richly illustrated. Tells how to build from complete materials or from patterns costing from $2.00 to $15.00. Write postal for this free book today.

Brooks Mfg. Co., 8501 Sidney St., Saginaw, Mich.

Will the Automobile be Driven by Kerosene?

(*Concluded from page 38.*)

The test showed the following figures:

	Consumption in pints	Cost cents a pint	Horse-power cost cents
Gasoline engine:			
Fuel	0.70	1.272	1.057
Oil	0.02	8.375	0.203
			1.260
Diesel engine:			
Fuel	0.60	0.508	0.366
Oil	0.03	8.375	0.305
			0.671
Automobile engine: Kerosene (G. C. device)			
Fuel	0.65	0.627	0.488
Oil	0.018	8.375	0.183
			0.671

Among the devices made in America which have proven successful, mention must be made of the Universal, Holley, Hart-Parr (tractor); Twombly, International Harvester (tractor), Rumely (tractor), Gas Traction (tractor), Mietz & Weiss (stationary), Hornby-Ackroyd, Dela Vergne (stationary). A number are still in the experimental state.

In his experiments, Mr. Holley has found that a Ford car fitted with his device will give 28 miles a gallon on kerosene and 32 on gasoline as bought at random in Detroit. This is a per-mile cost of 0.35 cent for kerosene and 0.6 cent for gasoline (based on 10 and 20 cents). Mr. Holley states as a result of several years' experimentation in this line that he believes "the kerosene carburetor will be used largely in the commercial line, such as delivery wagons, motor trucks and commercial boats at an early date. As to motorcycles and pleasure vehicles, it has a future but gasoline will be used for a considerable period."

The makers of the Universal state in their guarantee that "The device will give a greater range of speed control than cold gasoline, and a range equal to heated gasoline; that it will give from 10 to 15 per cent more power a pound of fuel on kerosene than on gasoline," and back up both claims.

These instructions and the foregoing seem to show that there is a big future in kerosene as an automobile or internal combustion engine fuel, and that its use is not far away, nor will it entail any great amount of change in existing motors, other than the substitution of a suitable vaporizer.

TABLE OF COMPARATIVE KEROSENE AND GASOLINE RESULTS TAKEN FROM WINNIPEG AGRICULTURAL TRIALS, 1912.

Fuel, Make, Entry Number, Class, Type and Size Engine, Plows, Mileage Traveled	Fuel in Pounds	Cost of Fuel an Acre Plowed	2-Hour Brake Test: Average BHP	2-Hour Brake Test: Fuel in Pounds	2-Hour Brake Test: Cost in Cents—Fuel—BHP-Hour	2-Hour Brake Test: HP-Hours of a Gallon of Fuel	2-Hour Brake Test: HP-Hours of $1.00 Worth of Fuel
Kerosene—Avery 19 D, 2-cylinder, 7.75" bore, 8" stroke; 4 Avery 14" plows, 6 miles	105.0 K 3.0 G	$0.584	27.50	41.5	1.386	10.47	72.3
Gasoline—Avery 3 B, 2-cylinder, 7.75" bore, 8" stroke; 4 and 5 Avery 14" plows, 6 miles	65.5	0.468	25.87	32.75	1.763	11.03	56.7
Favors Kerosene by per cent	.....	—19.85	5.78	—22.1	27.2	— 5.34	27.5
Kerosene—1HC 21 E, 2-cylinder, 9.5" bore, 12" stroke; 8 P. & O. 14" plows, 6 miles	171.5 K 1.0 G	$0.474	48.90	75.5	1.430	10.22	70.5
Gasoline—1HC 9 C, 2-cylinder, 9.5" bore, 12" stroke; 8 Oliver, 14" plows, 6 miles	141.0	0.578	49.34	63.0	1.788	10.96	56.3
Favors Kerosene by per cent	.....	21.9	—0.9	—16.5	25.0	— 6.7	25.2
Kerosene—Ault. & Tay. 22 E, 4-cylinder, 7" bore, 9" stroke; 7 Deere, 14" plows, 6 miles	115.0 K 8.0 G	$0.395	54.32	80.5	1.361	10.66	73.5
Gasoline—Ault. & Tay. 12 C, 4-cylinder, 7" bore, 9" stroke; 9 Deere, 14" plows, 6 miles	97.5	0.368	58.60	63.5	1.509	12.92	66.3
Favors Kerosene by per cent	.....	— 6.8	— 7.3	—21.1	10.9	—17.5	10.9
Kerosene—Rumely 23 E, 2-cylinder, 10" bore, 12" stroke; 8 and 9 Rumely 14" plows, 6 miles	129.25	$0.337	51.40	72.5	1.295	11.20	77.4
Gasoline—Case 13 C, 2-cylinder, 10" bore, 12" stroke; 10 Case-Sattley 14" plows, 6 miles	155.75	0.519	55.70	83.0	2.096	9.41	44.4
Favors Kerosene by per cent	.....	54.0	— 7.7	14.5	61.9	19.0	74.3

SOME AVERAGES.

Class or Division	Kerosene	Gasoline	Favorable to Kerosene	Similar Cases in 1911
			Per cent	Per cent
Cost of Fuel an acre, all competitors	47.927c.	49.725c.	2.7	33.8
Cost fuel-acre, 4 competitors above	44.75 c.	48.32 c.	8.0	21.5
Cost fuel HP-hour, all competitors	1.888c.	1.604c.	17.7	....
Cost fuel HP-hour, 4 competitors above	1.368c.	1.797c.	31.4	37.2
HP-hours a pound of fuel, all competitors	1.182	1.504	27.2	....
HP-hours a pound of fuel, 4 competitors above	1.349	1.584	17.4	....
HP-hours a gallon of fuel, 4 competitors above	10.64	11.08	— 3.9	— 2.5
HP-hours a $1.00 worth of fuel, 4 competitors above	73.42	55.90	31.4	60.3

1911 Prices—Kerosene 12 cents a gallon of 7.9 pounds.
Gasoline 20 cents a gallon of 7 pounds.
1912 Prices—Kerosene 14.5 cents a gallon of 7.9 pounds.
Gasoline 19.5 cents a gallon of 7 pounds.
Increase in price of Kerosene, which is unfavorable, 20 per cent.
Decrease in price of Gasoline, which is unfavorable to Kerosene, 2.5 per cent.

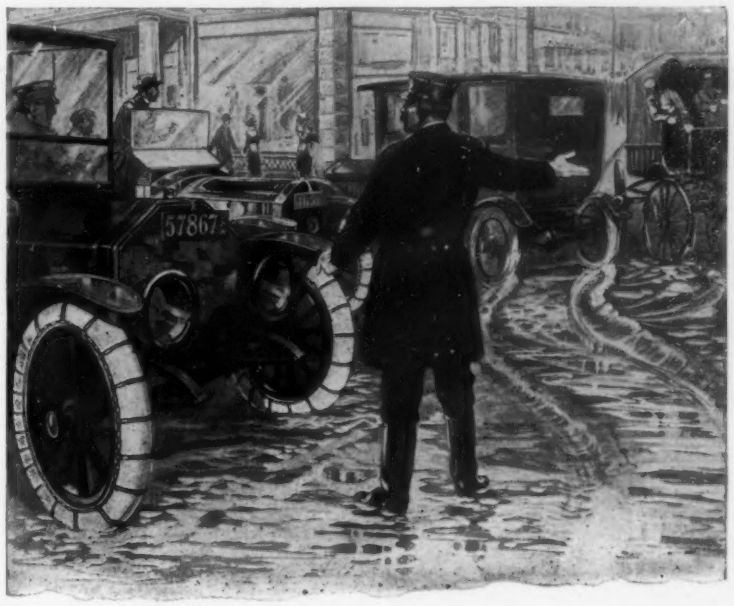
The Making of a Pneumatic Automobile Tire

(*Concluded from page 3.*)

Spreading and Calendering.

Rubber which is used for the general line of molded goods, solid tires, some kinds of tubing, etc., goes directly to the various departments from the green-stock storeroom, while rubber used for boots and shoes, waterproof fabrics, many of the druggists' sundries, belting, pneumatic tires, inner tubes, etc., has to be sheeted out, and some of it forced into fabric before it goes to the various departments. This sheeting-out of the gum, as well as applying the rubber to fabrics, is done generally by two methods; either by spreading a solution of the rubber and naphtha onto the fabric, or by calendering the rubber between heavy rolls in a rubber calender.

In the spreading process, a machine called a spreader is used. The fabric to which the rubber is to be applied is mounted in a roll at one end of the spreader and from the roll passes through a trough of rubber cement, and then up over a so-called doctor roll, and under a knife edge, which allows only enough cement to pass through to fill the pores of the fabric. From this knife the cemented fabric passes over a steam drying chest and is then rolled up with a roll of liner cloth to prevent its sticking together. Fabric thus treated must be put through the spreader a number of times before it



"There's Where You Are Wise!

That Other Fellow is a Menace to Everyone's Safety"

Nine-tenths of all automobile accidents are caused by skidding and by foolish dependance on rubber alone. In these days of crowded streets and congested traffic, the motorist who does not take precaution to guard against every possibility of disaster is ***next to criminal.***

"The ever-present danger that is quite as much of a terror to the experienced driver as it is to the novice is ***skidding.*** There is nothing that makes a man lose his nerve so thoroughly or dread a repetition of the experience so keenly as a bad skid that ends in a broken wheel against a curb, or that makes matters far worse by "side swiping" a moving trolley car. To feel the car start to slide from under you, aiming directly at the nearest obstruction, despite all manipulations of the wheel and brakes—well, once is too often."

Weed Anti-Skid Chains

VS.

Slipshod Traffic

Traffic policemen, by the hundreds, interviewed in all the large cities throughout the country, express the unanimous opinion that their work would be greatly reduced; that nearly all ***skidding accidents would be eliminated*** if motorists would take the precaution of always carrying WEED CHAINS, and putting them on when the roads and pavements are wet, slippery and uncertain, or covered with snow.

Some of these ***guardians of public safety*** go so far as to say that the time is not far off when State Legislatures will make ***the use of Weed Chains compulsory,*** for the protection of life and property.

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they afford perfect traction and adequate brake control.

On the Front Tires

they act as ladders to enable the front wheels to easily climb out of mud ruts, car tracks and all uneven places in pavements or roads, always insuring absolute steering control, eliminating all chance of the front wheel skid.

If you haven't a set of ***WEED CHAINS,*** or if you have a pair for the rear tires only, ***get a full equipment now.*** Delay is dangerous. Stop at your dealers today and ***WEED CHAIN your car to safety.***

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Wherever you go, you'll be proud of your *National*. It is the result of twelve years of concentration upon the harmonious combination of beauty, luxury and reliable service.

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Powerful and reliable Brakes.
Spacious Interior.
Adequate Baggage-Carrying Compartment concealed in body, but easily accessible.
Tire Pump, integral part of motor. Inflates a tire in three minutes.
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128-inch Wheel Base.
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361 Broadway, New York

has accumulated rubber to be used in the products for which it is intended.

For calendering rubber, a machine called a rubber calender is used. This machine is made with three and sometimes four heavy rolls, capable of very fine adjustment. The rubber from the green-stock storeroom is first warmed up on a small mixing mill and is then fed between the rolls of the calender, coming through in a thin sheet of required thickness, and is wound up in a liner cloth and sent directly to the departments, where it is used for inner tubes, druggists' sundries, etc., where only rubber and no fabric is used. Where the rubber is to be applied to fabric, the fabric is put through the calender rolls with the rubber, and the rubber is literally ground into the fabric. Fabric thus treated is known to the trade as friction, and is generally used in the manufacture of pneumatic tires, belting, hose, etc. For boots, shoes, and other special work, calenders are used which are equipped with rolls engraved with the shapes of the soles and other parts of the articles in question, so that the sheet of rubber coming from the machine has imprinted on it the shapes and thickness of the articles for which it is intended.

After passing through such of the processes described as are required, the rubber is ready to be made up into the various articles known to the rubber trade, such as boots and shoes, mackintoshes, waterproof fabrics for balloons, aeroplanes, tentings, etc., mechanical goods such as rubber heels, horseshoe pads, packing, tiling, automobile and other bumpers, artificial fish bait, etc., druggists' sundries, such as nursing-bottles, nipples, syringes, bulbs, hot water bottles, tubing, etc., tobacco pouches, rubber belting, golf and other balls, insulated wire, fire and garden hose, inner tubes, tires and the many other commodities into the manufacture of which rubber enters. As this article has to do more especially with the manufacture of automobile pneumatic tires, we will omit the various methods used in the manufacture of the numerous articles mentioned above and pass directly to the manufacture of pneumatic motor car tires and inner tubes.

When the first pleasure automobiles were made in any quantities, the tire used was of the single tube type, and fastened to a crescent shaped rim by means of lugs or bolts, and cement. This proved very unsatisfactory, and the clincher type tire, using an inner tube, then came into prominence as an automobile tire. With some variations in design, this type of tire still continues to be very popular, but during the growth of the automobile industry, the so-called straight-sided or detachable automobile tires have been developed, and have come into favor. Some of the latter type of tire are of the regulation Dunlop type, others being somewhat different. Most all of these so-called straight-sided tires have wires in the beads to keep them from flying off the rim. With the development of the motor truck industry, solid tires have come to be used where heavy loads have to be carried. This type of tire has been developed from the original wagon tire to the present various types of improved motor truck tires, and so-called high efficiency solid tires, of peculiar design, to give the desired resiliency and wearing qualities.

The Birth of an Automobile Tire.

From the calender room of the rubber factory, the stock is received in the automobile tire department, in the form of large rolls of rubber coated fabric, and in rolls of sheeted rubber of various thicknesses and widths. The rubber coated fabric is first cut into strips of proper widths so that the edges will extend from bead to bead over the crown of the tire. These strips are always cut on the bias, generally at a 45-degree angle, with the edge of the roll, and were formerly all cut on a cutting table, a table about 50 feet long and 6 feet wide covered with sheet metal. The cutting was done by two men, each having a knife and each cutting half way across the cloth along

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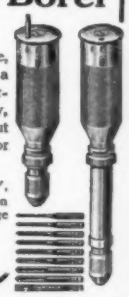

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the edge of a straight-edge so arranged as to be always set at 45 degrees with the edge of the table. Gradually this method of cutting is being put aside by the use of the bias cutter, an extremely up-to-date machine having jaws which ride up to the end of the fabric and pull it for a certain distance under a knife set at a 45-degree angle, the knife being set to cut just when the jaws have arrived at the limit of their motion. The action is repeated so that the machine cuts about eighty strips a minute. These strips are fed onto a series of belts which carry them to where they are placed, by boys, into a book having a leaf of cotton cloth between each strip of gum fabric, to prevent the strips from sticking together.

The majority of automobile tires to-day are built by the hand method, and in this process the books of fabric are laid up and spliced into proper lengths to go around the tire and allow a proper lapping for the splices. The proper number of these laid up pieces, or plies, as they are called, are placed together with cotton cloth between and taken to the tire builder. The tire builder mounts the core, upon which the tire is to be built, on the building stand, generally cementing it so that the first ply of fabric will stick in place. The first ply is then stretched onto the core and spliced, rolled down with a hand roller onto the sides of the core, and trimmed with a knife at the base. The following plies are put on and rolled down in the same manner, the beads being put in at the proper time, according to the size and the number of plies to be used. After all the plies have been put onto the core, the so-called cover rubber is put on. This cover rubber is generally a sheet of rubber about one sixteenth of an inch thick or more, and of the same compound as the rubber on the fabric.

In the case of the machine built tire, the result is the same, but the stock is handled as follows: After the rubber-coated fabric has been cut on the bias cutter, the strips are spliced and rolled up in rolls on a spindle which is placed in the so-called tire building machine. The tire core is mounted on a stand attached to the machine so that it can be revolved by power and the fabric is drawn onto the core from the spindle under a certain definite tension. The tire machines roll the fabric down by power, and the beads are put into place before the tire and core are removed from the machine. Thereafter the process is the same as in the case of the hand-built tires.

After the cover rubber is in place the tire is ready to have the tread applied. The tread is made up independently of the tire by laying up narrow strips of rubber, in different widths, in such a way that the center of the tread is thicker than the edges. In the case of the so-called single cure tires, which are wholly vulcanized at one time, this tread is applied to the tire directly after the cover, a strip of fabric called the breaker-strip, generally being placed underneath, and the building of the tire so completed.

How the Tire is Cured.

In the general method of curing, the tire is allowed to remain on the core, and is either bolted up in a mold and put into an ordinary heater, or it is laid in a mold and put into a heater press where the hydraulic pressure keeps the two halves of the mold forced together during the vulcanizing process. After the vulcanizing is completed, the tire is removed from the mold, the inside is painted with a French talc mixture, the tire inspected and cleaned, and so made ready for the market. In some methods of curing, the tire is put into a so-called toe-mold, which is virtually a pair of side flanges, reaching up only as high as the edges of the tread on the sides of the tire. After the flanges are fastened into place, the whole is cross-wrapped, the cross-wrapping coming in direct contact with the tread. The tire in this condition is then put into the heater and vulcanized, giving the so-called wrapped tread tire. Still another form of curing is to inflate a kind of canvas inner tube inside the tire and place the whole in a mold. This is known as the air-bag mold process.

From the case of the single curved tire just described, we will take up the case of the so-called double cure tire, in which the tire receives two separate vulcanizations. In this system of tire manufacture, the tire carcass is semi-vulcanized before the tread is applied. This first vulcanization is always done with the tire on the core, and either bolted up in a mold or cured in a mold in a heater press, the period of vulcanization being only long enough to partially cure the rubber. The tire carcass is then taken from the mold and mounted on a buffing machine, and that part of the cover which is to be covered by the tread is buffed to a rough surface, which is then given one or more coats of rubber cement, allowed to dry, and the tread, which is generally made of some quick curing compound, is then applied in the green state. The tire is cross-wrapped, either by hand or by a cross-wrapping machine, placed in a regular heater and given the second cure. This second cure is timed to complete the cure of the carcas sand also to completely cure the tread. After removal from the heater, the cross-wrapping is stripped from the tire, the tire inspected, the inside painted, and so made ready for the trade.

Authorities differ as to whether the integral construction or single cure method or the semi-cure method produce the better results. Advocates of both systems are able to advance strong arguments in support of their respective methods.

The Three Kinds of Inner Tubes.

Inner tubes for pneumatic tires may be classed under three headings, according to the method used in their manufacture, viz., seamed tubes, rolled tubes, and tube-machine tubes. By far the greater number of tubes come under the first two headings. For seamed tubes, the rubber is taken from the calender in the form of sheets from 1/16 to 3/16 of an inch in thickness. These sheets are cut into strips of proper length and just wide enough to make a tube of proper cross-section diameter when the two long edges are folded over and fastened together with rubber cement. These two long edges are cut on a bevel so that they make a good lap seam. The tube is then pulled over a mandrel of proper size and a thin piece of wet cloth rolled around it, and then it is spirally cross-wrapped with a long narrow piece of wet duck, for its entire length. The whole is then put into a regular heater and the tube vulcanized. After vulcanizing the wrapping is removed and the tube stripped from the mandrel, turning the tube inside out, so that the smooth side which was vulcanized next to the mandrel appears outside, and the rough side showing the marks of the cross-wrapping, is inside. The valve hole is then punched in the tube, the valve inserted and the open ends of the tube buffed down to a feather edge. The tube in this state passes to the splicers, who cement the buffed ends and splice them together, placing one open end within the other making a lapped seam around the tube about 2½ inches long. The cement used in splicing is generally cured by an acid which chemically vulcanizes the rubber without the application of heat. The tube is thus finished and ready for the market. Rolled tubes are made from very thin sheet rubber by rolling the same over a mandrel of proper size, until the required number of layers of thin rubber have been rolled on to give the tube the desired thickness. The tube is then wrapped, cured, and spliced, in exactly the same manner as a seamed tube. Tube-machine tubes are run from a tube machine exactly like wagon tires, except that a die is used which permits the rubber to flow out in tube form. This tube is then pulled onto a mandrel, wrapped, cured and spliced, the same as the seamed and rolled tubes.

Europe's Good Roads

(*Concluded from page 87.*)

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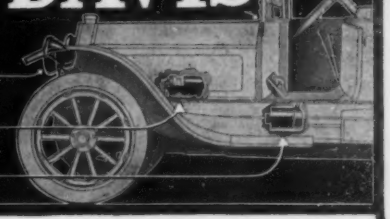

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If you would learn the real pleasure of motoring, purchase an automobile equipped with GRAY & DAVIS Electric Lamps, Lighting Dynamo, Electric Starter, or all three in combination.

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$1175 F. O. B. Detroit, has equipment of two folding and revolving occasional seats in tonneau, foot rest, in addition to regular equipment. Four cylinders 3¼-inch bore and 5½-inch stroke; 126-inch wheel base; 33 x 4-inch tires. Standard color, black. Trimmings, black and nickel.

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"32" Touring Car or Roadster, shown at right of six-passenger "32", fully equipped, $975 F. O. B. Detroit.

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Three Passenger "32" Coupe. $1350 F.O.B. Detroit, including electric lights, 100 ampere battery, electric horn, speedometer with clock, extra wide seat for three, 54 x 22 in., quick detachable rims, 33x4-in. tires, rear shock absorber, 106-in. wheelbase. Standard color, black. Trimmings, black and nickel.

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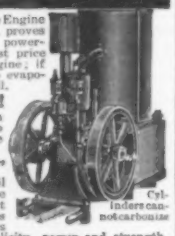

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biles, and are charged with the responsibility of seeing that driving licenses and registration and tax dues have been paid in the country of origin. The International Driving License, which has been put into use during the past couple of years, in no way precludes the obligation to conform to the demands of the customs officials and, in short, in one way or another this service works in conjunction with the roads control branches of the respective governments. On certain of the Swiss passes, all of them in fact that are open to automobile traffic, notably the Simplon and the Saint Gothard, a running time card, as it might be called, is issued by these same authorities limiting the passage over the mountain road to a certain pre-arranged time schedule, this in an attempt to regulate the speed on these dangerous mountain roads, and as such it certainly does work effectively, as one is not let out at the other end if he arrives before the hour indicated on the permit.

Taxation of rubber-tired traffic abroad is generally far in excess of what it is in America, but in France it does not go specifically toward road building or even amelioration, but is paid into the general coffers of the national treasury. Including bicycles (of which there are three million circulating in France) there is contributed a sum equal to nearly three million dollars per year. When the day comes—and there are signs visible which point that way—that this sum entire, save the costs of collection, is devoted to the building of automobile boulevards, call them by what name you will, at any rate thoroughfares intended only for fast traffic, France may be expected to double her lead over all countries of Europe as the automobilist's paradise. In this connection it is worthy of regard that automobile registration in France is considerably less than a hundred thousand vehicles, the largest French manufacturer producing only something like seven thousand chassis in a twelvemonth. The result is that there are six miles of the finest roadway on earth for each automobile that rolls over them. Some American manufacturer with a desire to pose as the real popularizer of the automobile, *à la portée de tout le monde*, as the French say, has only to follow in the footsteps of the exploiters of the kodak to find himself in touch with a world market which has as yet only been scraped over.

Partnership Use of a Motor Car

By P. H. McKilwin

SINCE there are a great many persons who have been deterred from buying and using automobiles by the cost of running and maintaining them, the suggestion that two or more men go into partnership in the ownership of a car and divide both the cost of the machine and the expense of using it offers a possible solution of the problem that confronts thousands who greatly desire to enjoy the pleasures of motoring but have not felt in position to do so.

The idea is new but there are a number of cases of the kind, one on Long Island in which seven friendly neighbors in a suburban place bought a car which is kept in a public garage and used to take them from their homes to the railroad station in the mornings and to meet them at the station in the evening; in addition to this, each part owner is entitled to the use of the car one day each week.

No doubt there are thousands of families that would gladly pay half or a third or quarter of the cost of buying and keeping an automobile, yet who would put off indefinitely the buying of a car for their own individual use.

There are two fundamental plans on which copartnership ownership and use can be carried out. The simplest is an even division of all expenses, irrespective of the personal equation, which has the advantage of rendering bookkeeping or account-keeping unnecessary and avoids disputes over liability for damage done by careless driving, inexperienced handling and various small abuses. Under such an arrangement one owner may get more mileage out of the car and tires, carry more passengers and generally get a larger return for his money than his partner. If the partners are particularly good friends or relatives and are indifferent to small differences of this kind, the matter of dual ownership is extremely simple. But if, on the contrary, it is desired that neither shall pay less nor more than his use of the machine makes equitable, it becomes necessary to divide the expenses into fixed and variable charges. The fixed charges include the cost of the car and of any equipment subsequently purchased, storage, insurance, and overhauling and repainting when these are agreed upon. The variable charges are those due to actual use of the machine, such as gasoline, oil and other supplies, tire wear, cleaning and so forth.

It is evident that the fixed charges should be divided equally, but the variable charges should be paid by the partners according to their actual use of the car and liability for them. Thus, if the car is kept in a private garage, the bills for simple storage could be rendered monthly and paid equally by the owners or alternately as agreed upon, but the bills for washing, adjusting, polishing, gasoline, and oil should be rendered weekly so that each of the owners can pay the bill for the week during which he actually used the car. This is on the assumption that the car is used alternate weeks by the copartners, which is likely to prove the most satisfactory arrangement.

In order to avoid misunderstanding, it is almost imperative that a carefully thought-out agreement be drawn up in duplicate and signed. This would state definitely the weeks on which each owner would have the use of the car. This gives each the advantage of an equal number of Saturdays and Sundays. They can trade off their time when one or the other is to be away on business or vacation. Should any differences arise over this or other matters, the obvious way out without causing ill feeling, is for one to offer to sell his interest or to buy his partner's.

A full line of insurance covering losses by fire, theft, accident or collision should be carried and the payment of the premium divided equally. The policy should cover small losses as well as the major ones, which is possible under the "full coverage" clause provided by the insurance companies.

Tires, like gasoline, are consumed and the consumption bears a close relation to mileage and to the way in which the driver uses the car. Therefore, it would probably be wise for each partner to keep a record of his mileage and pay his part of the tire bill on this basis. Repairs of punctures and blowouts would be chargeable to the one using the car at the time they occurred, except in cases where they resulted directly from cuts or other injuries known to have occurred while his partner was using the machine. Damages impossible to trace clearly should be divided equally.

Miscellaneous small repairs and replacements, which are not covered by the manufacturer's guarantee, would most equitably be charged against the one using the car at the time the fault developed. Of course, a break might occur during B's use of the car as a result of some unusual strain occasioned while A had the machine out, but this is an eventuality as likely to occur one way as the other.

A successful carrying out of the plan herein outlined is dependent upon the common sense and spirit of fairness that animate the parties to the arrangement. Each should constantly remember that he is entitled to only half the use of the machine and that his partner, by putting up with the same limited use and dual responsibility, is really making it possible for him to enjoy the use of a car at all.

What the annual costs to each are likely to be may be estimated approximately from the following table of itemized cost of maintaining two different types of family touring car, one a four-passenger light car costing $1,150 and the other a five-passenger car of about double the weight and power costing $2,200:

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by various processes is treated very fully in the **Scientific American Supplement.** The following issues will be found valuable to every worker or worker of metals:

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1646—Oxy-hydric Welding, gives a description of processes and cost.

1775—New Gas Fusion Process, describes the Koeln Muesener improvement in oxy-hydric apparatus.

1680—The Oxy-Acetylene Process, sets forth the uses and cost of this system.

1434—The Garuti Process of Generating Oxygen and Hydrogen, describes an economical way of making and using these gases for welding.

1305, 1447, 1480 on "**Aluminothermy**" or "**Thermit**" processes, describe and illustrate many remarkable welds, castings and other operations performed with the novel and useful series of metallic compounds, by which castings of steel and other metals and difficult welds can be easily made without forge, cupola or any sort of fireplace.

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1040—Aluminium Solders, gives several formulas in use when aluminium was almost a new thing in the arts.

1644—Soldering and Soldering Processes, gives broad general information, and contains in particular a method for pulverizing solders and allows of great use.

1667—Some Soldering Appliances, describes the blow-pipe and the furnace in their various forms.

1481—Soldering of Metals and Preparation of Solders gives many formulas for soft and hard solders and fluxes.

1610, 1622, 1628 contain a series of three articles on solders, covering the entire range of solders for all metals. No. 1628 contains formulas and instructions for **soldering aluminium.**

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Special Resources of American Libraries

EVERY scholar will welcome with enthusiasm the latest publication of the United States Bureau of Education, "Special Collections in Libraries in the United States," compiled by W. Dawson Johnston, librarian of Columbia University, and Isadore G. Mudge, reference librarian of the same institution.

Inaccessible books are the bane of every seeker after knowledge. The special bibliography only half solves the problem.

The time will come when no special bibliography will be considered wholly meritorious unless it contains, in connection with the title of every rare book, a list of the libraries in which the book is to be found; or, if this imposes too much labor upon the bibliographer, unless at least *one* copy of the book is thus located. With this improvement, coupled with the modern system of "interlibrary loans," the bibliographic millenium will be pretty nearly attained.

Pending such a consummation, a handbook similar to that just published by the Bureau of Education is an admirable makeshift. Here we find a list of libraries in which each department of knowledge is most fully represented, with sundry particulars as to the strength of each collection along a particular line.

To illustrate with a few out-of-the-way topics: If you are looking for the literature of philately, you find, by way of the index, that the Pittsburgh Carnegie Library has a philatelic collection of 342 books, pamphlets and periodicals donated in trust by the American Philatelic Society; while the Boston Public Library possesses 219 works on the same subject. If you wish to investigate chess try the Library Company of Philadelphia. This institution is the depository of Prof. George Allen's chess library, containing 1,070 volumes, besides newspaper clippings, manuscripts, and pictures relating to the game. The literature of the whaling industry is represented by 750 volumes in the New Bedford, Mass., Free Public Library. The Berkshire Athenæum, at Pittsfield, Mass., has a collection of addresses at agricultural fairs. Cornell University Library has a Petrarch collection of 3,700 volumes, and a Dante collection of 7,600 volumes (exceeded in importance, if at all, only by the collection in the Biblioteca Nazionale, in Florence). Williams College Library has 162 volumes relating to Phædrus. Harvard University has a collection of Yiddish literature numbering 4,500 volumes and 1,600 pamphlets. The Masonic Library of Cedar Rapids, Iowa, has the most important collection in the United States on freemasonry and related topics, which in 1898 numbered about 15,000 volumes, of which 5,000 were in foreign languages. The Library of the Supreme Council of the Ancient and Accepted Scottish Rite of Freemasonry, in Washington, has a collection of about 1,000 volumes on occult and allied subjects. And so on.

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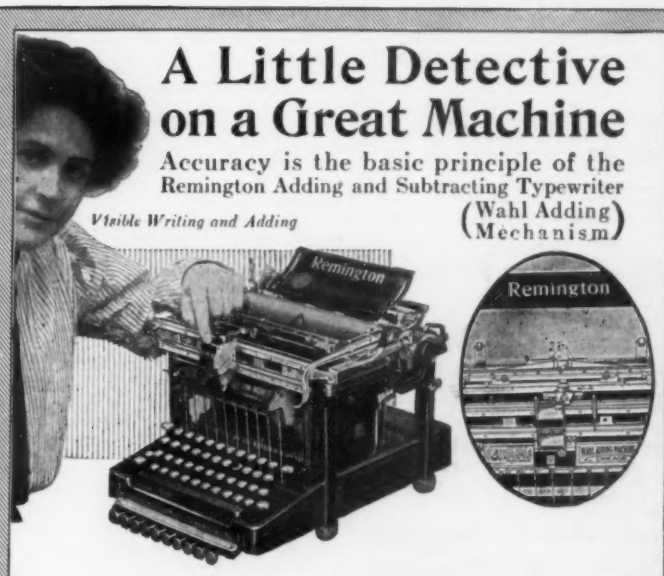

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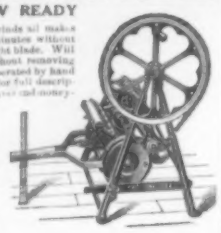

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RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

BEET TOPPER AND DIGGER.—J. DEVEY, Lehi, Utah. The object of the invention is to provide a simple and easily operated device for topping and digging, especially adapted for use in harvesting sugar beets, which will first top the beets while yet firmly held in the soil, and will afterward dig them. The present invention is an improvement over the prior patent, No. 975,218, granted to Mr. Devey.

BEET DIGGER, CLEANER, AND ELEVATOR.—J. DEVEY, Lehi, Utah. The object here is to provide a device for use in connection with an improved topper and digger, shown and described in a copending application Serial No. 612,179, for lifting, cleaning and loading the beets topped and dug or loosened from the soil by the said improvement.

KAFIR CORN HARVESTER.—S. B. PETER, 705 West 3rd St., Pittsburg, Kan. In the present patent the invention is an improvement in Kafir corn harvesters, and has for its object the provision of a simple inexpensive device for use in attachment to an ordinary farm wagon, for cutting the stalks of the corn to remove the valuable portion.

FENDER ATTACHMENT FOR MOWING MACHINES.—S. M. MARTIN, Heatherdale, Prince Edward Island, Canada. This attachment can be readily attached to a mowing machine. An object of the inventor is the provision of a device which will be simple in construction, which can be swung out of the way when it is not desired to use the same, and which is provided with an adjustable stop and shock absorbing mechanism.

Of General Interest.

DISPLAY RACK.—CATHERINE HOLLAND, 88 Zeidler Ave., Maspeth, L. I., N. Y. This invention has particular reference to rack devices adapted especially for domestic use or in connection with private laundries, the primary object being to provide a rack embodying cheapness of construction, facility to knock down and set up, lightness for transportation purposes, and stability of position while being used.

PROCESS OF MANUFACTURING BEET SUGAR.—V. KOLARAK, Owosso, Mich. An object of this invention is first to produce from decayed beets a juice with the highest purity possible when the purity of the beets is below 80 per cent. A further object is to obtain a better lime cake than by the ordinary method.

COMPOSITE BUILDING BEAM.—W. P. FRANCIS, 115 Marietta St., Atlanta, Ga. The invention provides an economical and simplified construction; provides anchoring devices for uniting the masonry and the metal structure, the arrangement of which distributes uniformly the breaking of the strain over the entire structure.

WINDOW.—R. B. HARTSFIELD, 210 W. 114th St., Manhattan, New York, N. Y. The invention relates to windows having stiles mounted to slide up and down, and sashes pivoted on the stiles to admit of turning the sashes on the stiles. The aim of the invention is to provide a window arranged to permit of conveniently turning the sashes with a view to allow cleaning of the outer faces of the sashes from the inside of the room.

Hardware and Tools.

LATCH.—W. LARSEN, Westbrook, Minn. The invention pertains to latches particularly adapted for use in connection with doors, gates and the like, and the aim is to provide a device of this character which may be adapted with equal facility upon gates and doors which swing either toward the right or the left hand.

KEY LOCK.—L. B. HOWARD, P. O. Box 394, Los Angeles, Cal. This device may be used to fasten door keys in place to absolutely prevent a burglar from removing or turning the key from the outside, making it impossible to lock the door from the outside. It will also prevent children from removing the key from the lock, which is a source of great annoyance and causes the loss of many keys.

HOSE REEL.—C. WAGNER, 587 Hudson St., New York, N. Y. This hose reel is more especially designed for use on stand pipes in buildings to permit of quickly unreeling the hose with the water turned on and allowing an almost instantaneous passage of the water through the hose as soon as a fire breaks out and water is turned on from the stand-pipe.

METAL WORKING SHEARS.—C. H. PRINCE, 123 East Ave., L. I. City, New York, N. Y. The invention provides a pair of shears of compound leverage, the construction and arrangement being such that the handle levers of the shears are prevented from working loose, being pivotally mounted in housing carried by the blade ends.

Heating and Lighting.

BUILDING LIGHT.—J. STANLEY, 448 Mott Ave., Bronx, New York, N. Y. The intention here is to provide a building light for use on sidewalks, vault covers, area lights, sky lights and the like, and arranged to compensate for expansion and contraction, with a view to prevent breaking or cracking of the lenses.

IGNITER.—F. THOMAS, 473 Pine St., San Francisco, Cal. This invention consists essentially of an igniting device and an actuating means for normally holding the device in a dormant position, the actuating means being sensitive to atmospheric conditions and being actuated on a fall in temperature of the surrounding atmosphere to ignite the device and to thus set an inflammable material on fire.

COOKING UTENSIL.—F. D. CALKINS, 39 Charlotte St., Detroit, Mich. This utensil is in the nature of a foraminous vessel designed for use in steaming, boiling, etc., within an outer vessel. The invention relates particularly to means for reinforcing the foraminated body by means which are extended at one end to serve as legs for supporting the vessel and at their other ends as fastening means for holding the lid in place.

STOVE POLISHING MITTEN.—NELLIE M. SPRINGHORN, Blue Point, L. I., N. Y. The object of the invention is to provide an improved stove polishing rubber mitten designed to enable the user to keep a blackened stove in fine polish without requiring re-blacking for a considerable time, and to readily remove water, grease spots, and other extraneous matter, thus keeping the stove clean and nice for a very long time and without danger of rusting.

COMBINED KITCHEN CABINET AND CUPBOARD.—C. F. WELGE, care of Welge Bros., Chester, Ill. The permanent features of the cupboard are so arranged as to permit of the lower portion of the cupboard receiving and supporting a hinged lid provided on the cabinet. The lid forms the cover for a flour bin and for a kneading board which is solidly supported below the lid and conveniently located with respect to the bin.

BED-FAN.—R. N. CHRISTIAN, 4457 Oakenwalk Ave., Chicago, Ill. This invention relates to improvements in automatic fans and air circulators, and has for its object to provide means whereby the air above a bed may be cooled and caused to circulate. It consists principally of a series of flat horizontally disposed and spaced strips of flexible material arranged above a bed, said strips to have vertical movement at one end. It can be used in offices, workshops, out-door camps, and can be readily folded and packed away.

Household Utilities.

SASH FASTENER.—G. M. FARNHAM, Lincoln, Maine. The present invention has reference to sash fasteners, and is more particularly applicable to the character of sashes which are temporarily installed, such as storm windows, or window screens for porches or structures of a similar character.

Machines and Mechanical Devices.

MEANS FOR LAUNCHING TORPEDOES FROM THE SIDES OF SHIPS.—ALBERT E. JONES, Fiume, Austria-Hungary. This invention provides means for launching torpedoes from the sides of a submarine vessel, a torpedo boat or other light vessel at any angle and by means of a torpedo launching frame jointed to the sides of the ship. The purpose is to insure that the torpedo shall exactly follow the direction imparted by the torpedo launching frame at the moment at which the latter is locked and to prevent any deviation due to the gyroscope becoming operative prematurely.

PAPER POLISHING MACHINE.—H. OSBORNE, 992 4th Ave., Brooklyn, N. Y. This improvement relates generally to paper polishing machines and more particularly it is directed to a structure comprising coöperative parts whereby the pressure of the movable stone may be adjusted so that the operation of the parts may be rendered more efficient.

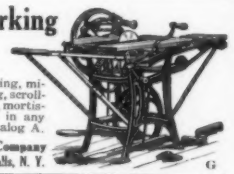
AUTOMATIC FILTER PRESS.—R. LEMMON and R. P. HOLMES, Boulder City, Western Australia, Australia. This machine is for use in separating the liquid from the solid portion of liquid pulp by means of pressure and compressed air, and is particularly applicable to the treatment of ores in a fine state of division commonly known as slimes, in which the gold or silver is dissolved and taken into solution by means of chemical solvents.

TUMBLER FINISHING MACHINE.—J. J. DENNING, Gas City, Ind. This invention provides a structure whereby a tumbler or the like may be quickly polished or finished. Means provide for holding and rotating a tumbler associated with a universally pivoted buffing member designed to be braced against a tumbler while rotating for polishing the same.

STARCHING MACHINE.—W. B. BUST, care of Eloesser-Heynemann Co., 77 Battery St., San Francisco, Cal. The invention provides improvements in starching machines such as are used for starching collars, cuffs and other articles, and whereby a constant supply of starch is furnished to the working portion of the upper cylinder to allow starching at a single operation even if the article is of a length in excess of the circumference of the cylinder, thus greatly increasing the machine's output.

CAN HEAD LINING AND ROLLING MACHINE.—H. L. GUENTHER, 278 N. Ave. 23, Los Angeles, Cal. This machine is for use in placing liquid cement or other packing material onto the flanges of can heads, and to bend over the flange edges, to confine and hold

Wood-Working Machinery



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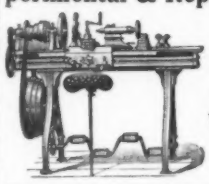

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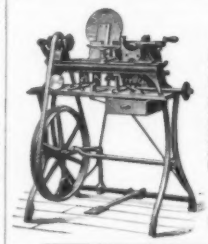

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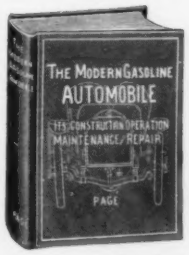

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Railways and Their Accessories.

BRAKE SHOE.—J. E. WORSWICK, 102 Church St., Montgomery, Ala. This improvement is in car wheel brake shoes and dressers, especially in that class of such devices wherein an insert of comparatively hard metal is combined with a body portion of softer metal and affords a wearing surface to operate upon the car wheel. The invention relates to certain improvements in the insert construction.

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GAME APPARATUS.—H. G. ROBINSON, L. B. 1733, Salt Lake City, Utah. This game is similar to golf. Marbles are used in place of golf balls, and a knocker instead of golf sticks is used, this knocker of thin steel and having at one end a grip by which the said end of the knocker may be drawn back, so that when it is freed it will hit the marble with sufficient force to propel it in the direction of the pocket, which is pivoted so that it may be moved as desired.

Pertaining to Vehicles.

SPRING WHEEL.—E. L. GOLTRY, R. F. D., Red Oak, Iowa. This improvement is in wheels which are provided with an elastic tire or tread formed of spring metal parts or members and intended as a substitute for the expensive pneumatic or solid rubber tires usually employed on the wheels of automobiles and other motor-driven vehicles.

SIGNALING DEVICE.—CHARLES A. SCHINDLER, 287 Palisade Ave., West Hoboken, N. J. The invention relates to signaling devices such as shown and described in the Letters Patent of the U. S., No. 1,015,715, formerly granted to Mr. Schindler. The object of the present invention is to provide a device, more especially designed for the use of chauffeurs and other drivers of vehicles, and arranged to enable the user to readily give an audible signal during the day and a visible signal at night to a following vehicle whenever it is desired to turn out of the direction in which the vehicle is traveling or for other purposes. Use is made of a glove provided on one finger with spaced contacts, either of which is adapted to be engaged by a circuit-closing contact on an opposite finger, the said contacts being in two electric circuits connected with a single source of electrical energy, one circuit containing an electric lamp and the other an audible alarm.

CART.—F. T. WALTHER, R. F. D., Scribner, Neb. The object of the invention is to provide a simple, cheaply constructed cart, light in weight, yet strong and nicely balanced, and consequently of light draft. With this improvement, the horse can travel in a smooth path, and the wheels will also travel in the beaten portion of the road. By moving the seat to the proper position, the body can be so balanced that the weight is taken off the horse's back.

GEARING.—C. E. COLLINS, 255 West 131st St., Manhattan, N. Y., N. Y. This invention refers especially to gear casings adapted especially for automobile practice. The casing secures greater facility in inspecting and making repairs in that type of automobile transmission mechanism in which are used both the slidable gear speed changing devices and the worm driven mechanism than has hitherto been possible.

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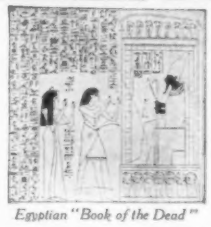

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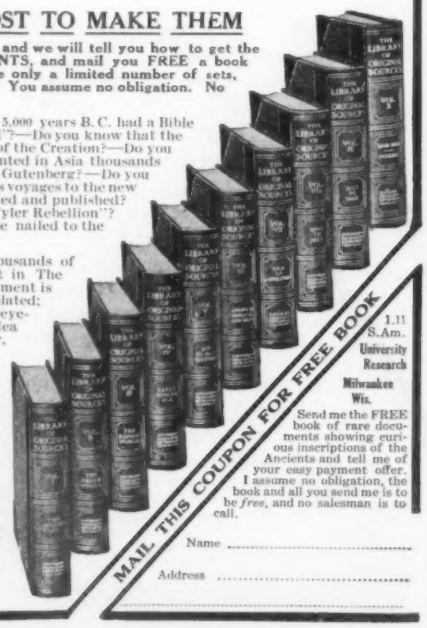

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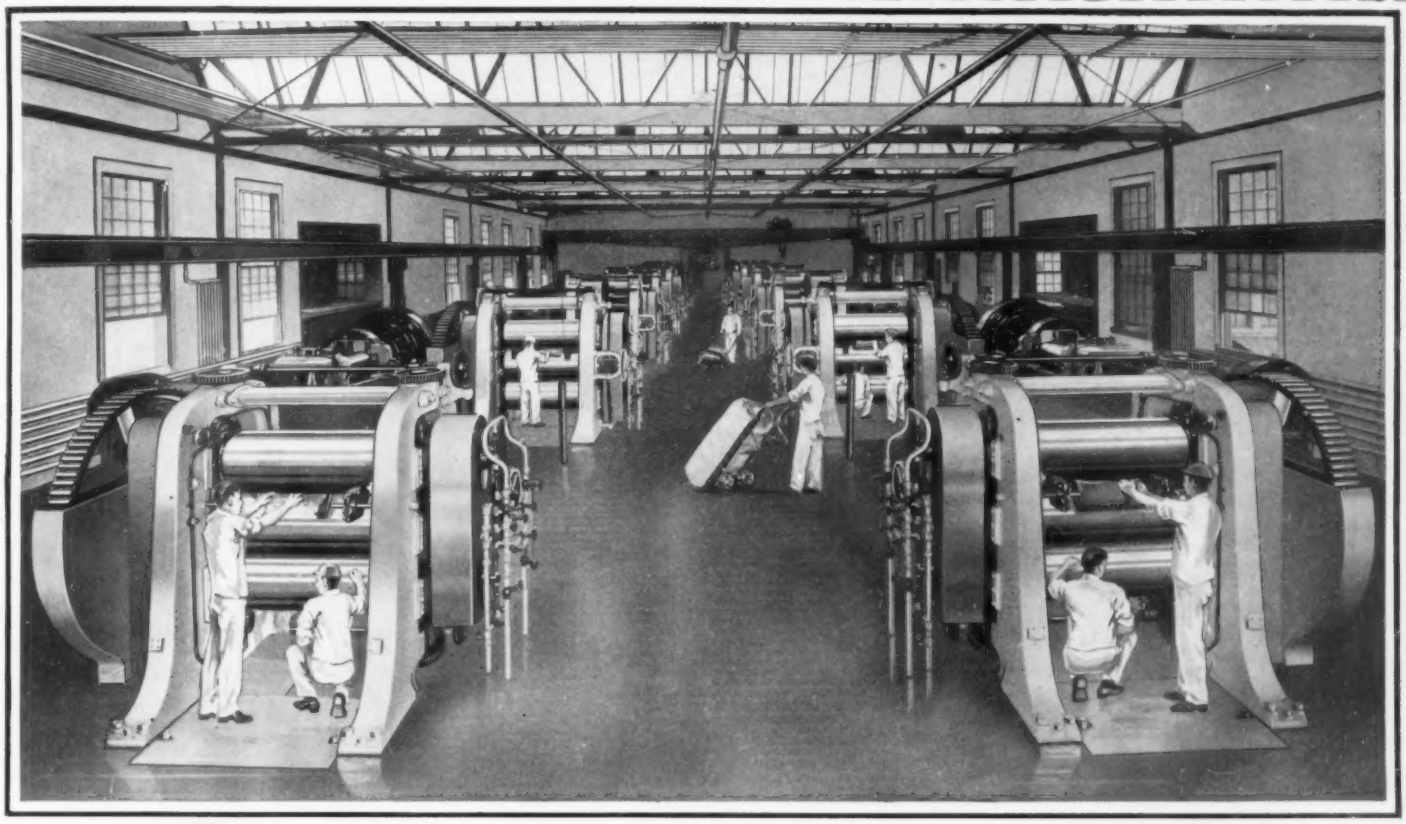
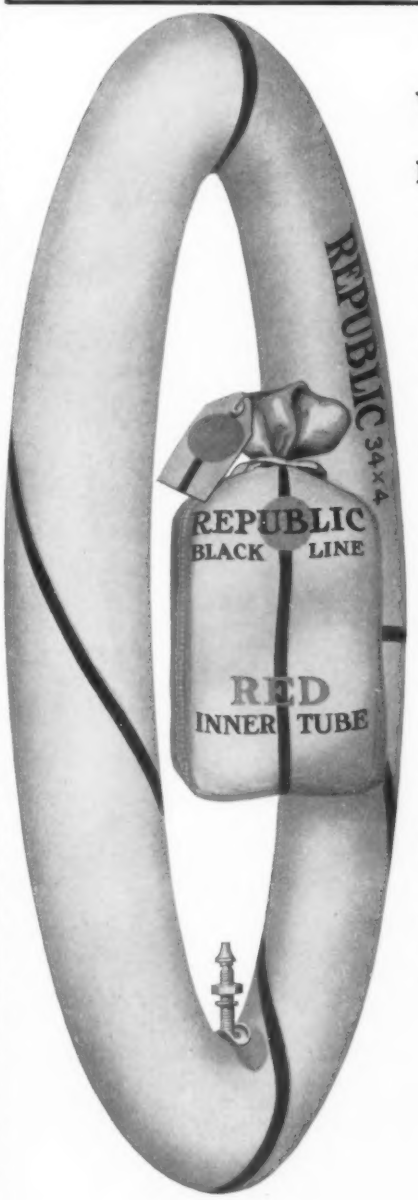


This is The Republic Rubber Company's New Calender Room



Republic Black-Line
Red Inner Tube

Where machines and brains make tire mileage for YOU

Republic Staggard Tread Tires give you the mileage you really ought to get because their foundation is *right*.

The foundation of a tire consists of alternate layers of fabric and rubber. And the efficiency of any tire depends to a great extent upon the manner in which the fabric and rubber are treated and combined.

The illustration above shows the Republic Calender Room—the new "rolling mill" of this rubber plant where foundations for Republic tires are made.

In this great room man's skill and ingenuity and modern machinery combine to make the *right* foundation for Republic Tires. Scientific, painstaking care is exercised in every operation from testing and drying the fabric to calendering ("rolling") the rubber and combining the two under proper heat and pressure.

And on this *right* foundation is put the Staggard Tread—the tread of extra thickness that leaves the full-thickness plain tread after the center studs eventually wear off.

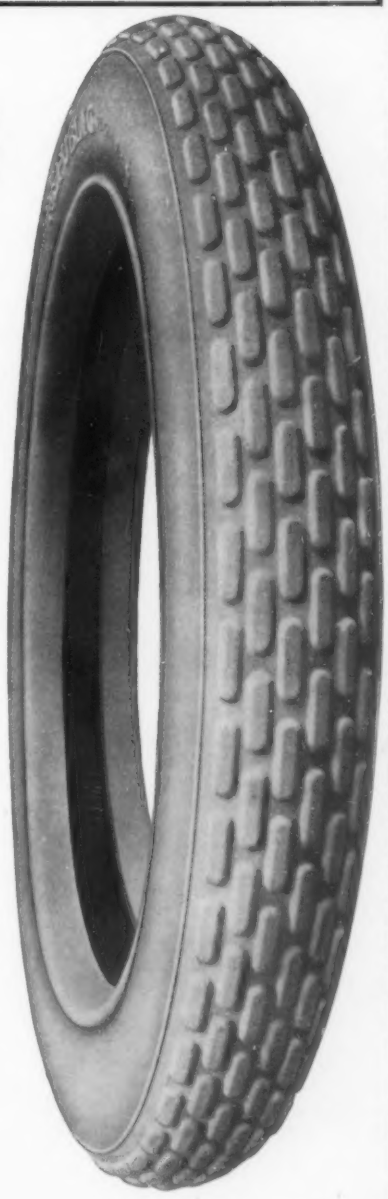
The Staggard Tread is protection against skidding, and really economical because of the extra mileage it gives you.

Write today for beautiful folder on this wonderful new Calender Room.

THE REPUBLIC RUBBER COMPANY
YOUNGSTOWN, O.
Branches and Agencies in the Principal Cities

REPUBLIC
STAGGARD
TREAD TIRES

Republic Staggard Tread Pat. Sept. 15-22, 1908



The Original Effective
Non-Skid Tire

What Shows Don't Show

By R. E. Olds, Designer

You'll see the new model of Reo the Fifth at your local Automobile Show.

It will strike you as beautiful, luxurious, roomy—having every final touch.

But here are things you can't see. And they mean, in the end, more than all that shows.

Tire Mileage

Tires on a car form the chief item in upkeep. Tire-saving means more than all other savings together. Every old motorist knows this.

So this year I add 30 per cent to my tire cost, to add 65 per cent to the average tire mileage. I give you tires 34 x 4. Compare them with rival cars.

The usual tires on this type of car would more than double your tire cost, so tire makers say.

No Possible Flaws

The steel in this car is twice analyzed, to make sure it accords with my costly requirements.

The gears are tested in a crushing machine, to prove that each tooth will stand 75,000 pounds. This test is usually made with light hammers.

The springs are tested in another machine, to stand 100,000 vibrations.

I use in this car 190 drop forgings. The average cost is twice that of steel castings.

But they give me lightness and strength. And hidden flaws can't occur in drop forgings.

The various parts of this car get a thousand inspections. Thus all the uncertainties are completely eradicated in building this Reo the Fifth.

No Broken Bearings

I use in this car 15 roller bearings, 11 of them Timken, 4 Hyatt High Duty.

They cost five times as much as the usual ball bearings. But good roller bearings don't break under strain.

No Overtax

It's the sudden shock which shows up a car's weakness, not the ordinary tests. And sudden shocks will come.

To withstand them, I give to axles and driving parts 50 per cent over-capacity. I have made them all ample for a 45 horsepower car.

To prove them out, I ran one of these cars for 10,000 miles, at top speed on rough roads. I met at its worst every possible road shock, and not one important part gave out.

I use 14-inch brake drums. I use 2-inch, 7-leaf springs. I use costly steels—chrome nickel, vanadium, manganese—all to ward off an over-tax. I place cost below safety in this Reo the Fifth.

No Troubles

That isn't quite true. All machines have their little troubles. But I've gone to the limit to save trouble with this car.

Each engine is tested 20 hours on the blocks, and 28 hours in the chassis. There are five long-continued tests.

My carburetor is doubly heated—with hot air and hot water—to save the troubles with low-grade gasoline.

I use a 875 magneto to save ignition troubles. I use a centrifugal pump, instead of a syphon, to insure the water circulation. That costs about $10 extra.

Cars are built slowly and carefully, parts ground over and over. I limit my output to 50 cars daily, so nothing shall be slighted.

No Skimping

To make the car show my infinite pains, I give equal care to the finish.

The body has 17 coats. The luxurious upholstering is of genuine leather, filled with the best curled hair.

There are three electric lights, and the dashboard lights are flush. And the whole car, even under the hood, is fully nickel-trimmed.

Center Control

Our center control is exclusive to this car. All the gear shifting is done by one small handle, completely out of the way. It is done by moving this handle only three inches in each of four directions.

Both brakes are operated by foot pedals. So no levers at all clog the way of the driver. And this permits of the left side drive.

No other center control will please a man who once discovers this.

Add $200 to My Cost

These extremes, I figure, add $200 to the necessary cost of this car.

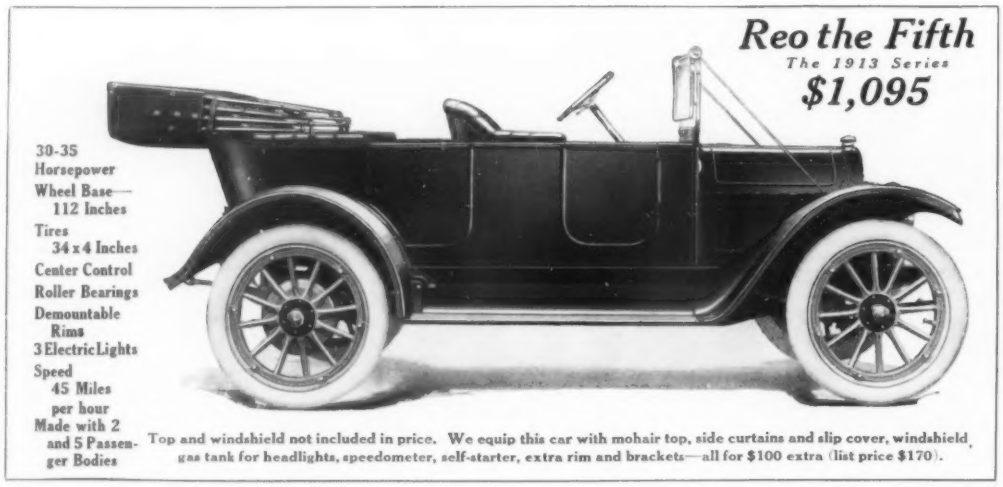
They cut down our profits. They force us to factory efficiency. They compel us to build every part ourselves. And, to minimize cost, we build only one chassis.

But these things save users from three to ten times what it costs me to give them to you.

They insure to you safety, economy, comfort. They insure to me that reputation I have spent 26 years in acquiring.

I find that car users, more and more, are coming to look for this class of car. Our output is always much oversold. And this year, with 60,000 excellent cars to my credit, the demand will be greater than ever.

A thousand dealers are now ready to show this new model of Reo the Fifth. Our 1913 catalog is also ready. Write us for it now.



Reo the Fifth

The 1913 Series

$1,095

30-35 Horsepower
Wheel Base—112 Inches
Tires 34 x 4 Inches
Center Control
Roller Bearings
Demountable Rims
3 Electric Lights
Speed 45 Miles per hour
Made with 2 and 5 Passenger Bodies

Top and windshield not included in price. We equip this car with mohair top, side curtains and slip cover, windshield, gas tank for headlights, speedometer, self-starter, extra rim and brackets—all for $100 extra (list price $170).

R. M. Owen & Co. General Sales Agents for Reo Motor Car Co., Lansing, Mich.

Canadian Factory, St. Catharines, Ont.

Garford "SIX"

¶The Garford "Six" is one of the world's most finished products.

Please address Dept. 21

The Garford Company
Elyria, Ohio

BERLIN LIMOUSINE *Seven Passengers, $6000*	*LANDAULET* *Seven Passengers, $5700*	*PHAETON* *Five Passengers, $4500*
LIMOUSINE *Seven Passengers, $5600*	*TOURING CAR* *Seven Passengers, $4500*	*RUNABOUT* *Two Passengers and Rumble, $4500*

Handsome catalogue on request

PERSONAL NOTE. It seems to me that this ad is peculiarly free from tire "bombast." It states plain facts in a way that cannot fail to appeal to the thousands of motorists who are keenly desirous of getting the exceptional tire service which the United States Tire Company is so admirably fitted to give its patrons.—J. D. ANDERSON

There is a Representative House in every Business

In the tire field the place is admittedly held by the

United States Tire Company

IT is a great achievement in these days of big business to be the representative concern in any line.

Such a reputation is extremely difficult to acquire and equally difficult to maintain.

The United States Tire Company occupies this position in the realm of motor tires by virtue of a deliberate purpose to produce tires of such quality, and to conduct its business on such a plane and thru such representative dealers as would naturally give it first rank in its field.

Since the day the company was organized the impelling motive in all its operations has been this: To raise the standard of motor tire quality and to give to the tire user a character of service after the purchase of a tire that is in keeping with the position which the company occupies in the industry.

Clearly no other tire company has been in a position to contribute so much to the actual improvement of tire quality as has this company. With the facilities and experiences of four immense tire organizations to draw upon, it has been possible to evolve a tire of such composite strength and such uniform goodness as to practically establish a new era in tire making.

The phrase "United States Tires are good tires" has become an axiom in the trade and among the users of the tires.

"Tire-ly Satisfied"

Not content with its success in producing a superior grade of tires, this company has sought to have its product reach the motorist thru the most representative dealers it has been possible to secure in every community where United States Tires are sold.

The fact that today four-fifths of the best, most reliable dealers are handling these tires—and in many cases handling them exclusively—is sufficient proof that the tires have made a highly successful appeal to the calm judgment of the trade in the face of the most vigorous competition.

Another proof of the recognition which has been given these tires is to be found in the fact that the manufacturers of the highest-grade cars are either supplying them as a part of their regular equipment or will gladly furnish them when requested.

United States Tires have come to be recognized as the ideal equipment for the country's finest cars.

Stated briefly, the United States Tire Company expects to maintain its dominant place in the tire field, first, by the manufacture of strictly high-grade tires; second, by offering its product thru dealers of the highest standing in every community; and third, by guaranteeing to every motorist the fairest, squarest treatment it is possible to accord him both when a tire is bought, and during its use.

United States Tires are good tires

Cost no more than you are asked to pay for other kinds

UNITED STATES TIRE COMPANY, NEW YORK